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METAL INDUSTRY

VOL. 37, NO. 1 FABRICATION · ASSEMBLING · PLATING · FINISHING JANUARY, 1939

Looking Forward in Electroplating

THE trends of research and development in electroplating indicate a bright future for this industry. In addition to improvements and wider adaptation of the presently used processes and equipment, new processes and apparatus are in the development stage which should markedly expand the utilization of plated coatings.

The use of nickel and iron electrodeposits for building of worn parts is expanding and significant savings have resulted from renovating worn, undersize metal parts by depositing metal electrolytically to make them as good as new. The problem of porosity of nickel coatings has been studied extensively and more general use of these studies will be made to insure quality plating. Bright nickel solutions are steadily replacing the standard dull nickel solutions with economies and better quality due to absence of cut-thru's from nickel buffing especially at the edges of the work.

Developments in chromium plating will include more extensive use of hard chromium plating, for example, on dies, rolls, molds, and sliding parts in engines. Better design of baskets and barrels for chromium plating will increase the use of small chromium plated parts because of lowered plating costs.

Large producers of sheet metal will market pre-plated strip and coiled metal with heavy electrodeposited coatings of nickel, copper, zinc, etc. and indeed considerable progress has been already made in this direction and extensive research is being pursued on such developments.

Automatic bright dipping of metals will increase which will accelerate the study of non-fuming bright dips. Definite progress has been made on both of these problems.

Greater attention will be given to coloring of metals with utilization of the relatively more stable oxide films in place of the sulfide films. The development of "Electrocolor", anodizing and the work of Erskine on cadmium coloring represent definite progress in this direction.

The use of alloy deposition for purposes other than corrosion protective purposes will increase especially for the preparation of alloys almost impossible to obtain by other means such as tungsten-low fusing metal alloys.

Trends in equipment for electroplating indicate greater use of organic tank linings and non-corrosive metals, continuous filtration with external heating and cooling coils for solutions, automatic temperature control of all heated solutions, pressure spray rinsing, flexible transfer mechanisms for automatics which will permit varying transfer times independently of main conveyor speed, and higher conveyor speeds with high current densities.

Research and developments in lacquering, enameling, and japanning as indicated on the review pages of this issue have also been decidedly progressive and presage a bright future for organic finishing.

Spectrographic Analysis

THE applications and utilization in industry of both the quartz and prism types of spectrograph have increased widely during the past year. The rapidity with which qualitative and often quantitative determinations can be spectrographically made of complex mixtures of metals using minute samples is amazing in contrast with standard gravimetric or volumetric technique. The determination of small amounts of impurities in lead, zinc, or copper by standard analytical technique would be time-consuming and with results which would be a matter of conjecture, whereas quantitative analyses can be obtained spectrographically often requiring less than sixty minutes for completion.

The uses of the spectrograph are many, some of them being qualitative analysis of metals, quantitative control of the purity of basic metals such as zinc, gold, lead and iron, and for control of zinc base die castings. It is used in crime detection, study of pathological tissue, in the food industry for detection of metallic impurities, and by plant physiologists for studying the effects of metals on plant growth. Routine spectrographic urine analyses are made of workmen who are exposed to lead or mercury fumes, silks are checked for metallic salt filters, and rubber compounds are examined spectrographically for traces of deteriorating copper or manganese. The chief uses of the spectrograph for electroplating are the determination of small amounts of metallic impurities in plating solutions such as zinc in nickel solutions, and for the detection of small amounts of metals co-deposited as brighteners.

Spectrographs are regarded by most laboratories possessing them as their most valuable and indispensible apparatus which pay dividends in labor savings and solution of problems unsolvable by any other means. They are no longer just a tool for the research laboratory but have been adopted widely for routine analysis and control.

Tariff Reductions on Zinc

IT IS difficult to conceive of sound arguments for the tariff reductions on zinc recently announced by the U. S. Department of State which provide for a reduction of the duty on zinc ores from $1.50 to $1.20 per 100 lb. and on slab zinc from $1.75 to $1.40 per 100 lb. Domestic producers were badly shaken by these reductions especially since they have been operating on a curtailed basis for many months to improve the statistical position of the market. As soon as the domestic zinc industry recovered its bearings, the price of Prime Western zinc dropped on Nov. 21 from 5.05c E. St. Louis to 4.75c and at the present writing is remaining steady at 4.50c.

Recent figures show a drop of $5 per ton in ore prices and many producers finding it difficult to operate in the face of the present cuts, have announced the closing of their mines for an indefinite period until there is a betterment of prices. The concessions incorporated in the new agreement penalize domestic producers and according to the Zinc Institute, "by reason of the most favored nation clause invite importations from all foreign zinc-producing countries except Germany."

Our relatively lower grade zinc ores, in contrast to the richer foreign ores, make it impossible for zinc producers to operate favorably treating zinc as a by-product. The present conditions indicate that the zinc industry employees must face wage cuts and unemployment which will be severe in Missouri, Oklahoma, and Kansas where entire communities depend chiefly upon the zinc industry for their livelihood. The opening of closed mines is a slow uncertain proposition, and continuous operation is essential to avoid waste and to maintain operations sufficient to meet emergency needs in our national defense.

The reasoning followed by those responsible for the reduction in the tariff on zinc ores is not easy to comprehend and it appears that the employees of the American zinc industry will have to bear the brunt of broader, perhaps "humanitarian" benefits which may accrue to other people or industries but which at present seem nebulous.

The zinc industry unavailingly protested the agreement with Canada signed on Nov. 17th and has recently filed a new protest on December 7th. The depressing effects of the new zinc tariff on the zinc industry as well as the concomitant effects on general business should be recognized by the proponents of the new tariff and equitable rates reestablished.

Review of Technical Developments in Electroplating and Finishing During 1938

By

Dr. Walter R. Meyer

Editor, Metal Industry

Introduction

The many significant developments in the field of electroplating and finishing during 1938 were presented not only by university and research laboratories but in an increasing degree by industrial laboratories. The present status of our developments in this field were depicted by several accounts of the history of plating by Higgins[1], Sage[2], and Hogaboom[3]. Contributions were made to almost all solutions and processes in metal plating and finishing, with particularly noted contributions to the subjects of copper and silver plating.

General Theoretical Problems

The complex study of CURRENT DISTRIBUTION on objects being electroplated was cleverly discussed by Kasper[4] who showed the effects of the container and position of anode and cathode on variously shaped objects to be plated.

The study of the EFFECTS OF pH on plating solutions was continued by Graham[5] who investigated the effects of various chemicals on the pH of copper, silver, gold, zinc, brass and tin solutions. Graham showed that, in the absence of carbonates, most of these solutions were not buffered below a pH of 12 and in the presence of carbonates, a buffered level exists at a pH of about 10.3.

Gerstle[6], recognizing the defects of the pH scale, proposed a new unit for hydrogen ion activities, namely "decihydrons."

The effects of various TREATMENTS OF THE BASIS METAL were shown by Hothersall[7] to markedly affect the porosity of nickel coatings.

Schloetter and Schellenmeier[8] found that the POROSITY OF METALLIC COATINGS increased with increasing roughness of the surface and suggested that good corrosion protection requires good previous preparation of the surface to be plated. These findings are in agreement with the work of Phillips[9] who showed that the type of polishing of steel had an effect on the relative corrosion resistance of coatings deposited there upon.

As a result of experience in bright nickel plating as well as from data on exposure tests, THE QUALITY OF SURFACE FINISH OF METALS used for plating, particularly steel, has undergone considerable improvement during the course of the year. Fulforth[10] pointed out the economics of proper selection of steel for plating as well as to indicate difficulties inherent in the steel itself.

Several contributions were made on POLISHING AND BUFFING and marked development was made in machinery for automatic polishing and buffing. Polishing technique for stainless steel was discussed by Snyder and Kohl[11], and Garner[12]. Silicon carbide and aluminum oxide types of abrasives are most suitable for polishing of stainless steel. Coarser grits may be used dry and finer grits and buffing on soft wheels with high melting point greases. Abrasives must be iron free otherwise, the surface may be contaminated with iron which will rust or discolor.

Very valuable contributions were made to COPPER PLATING particularly with regard to the effects of Rochelle salts, sodium carbonate, sodium cyanide and metal concentration by Graham and Read[13], and Wagner and Beckwith[14]. Young and Reid[15] showed that concentrated copper cyanide plating baths permit deposits to be obtained at higher current densities than from the dilute baths.

The effects of METALLIC IMPURITIES on the structure of deposits from cyanide copper baths were studied by Meyer and Phillips[16] who showed that many metallic impurities co-deposited with the copper resulting in either brightened or coarsened deposits.

Developments in CLEANING include a wider use of three-phase solvent degreasing[17], emulsion degreasing[18] and anodic alkaline cleaning. Wetting agents[19] became widely used during the year in alkaline cleaners and more general use of sodium silicates was made as a source of alkali[20].

One of the outstanding publications of the year was that of L. C. Pan's[21] on ammonia in BRASS PLATING SOLUTIONS. Pan showed that the ammonia concentration in brass solutions had a marked effect on stabilizing the copper-zinc ratios in deposits as well as maintaining consistent color.

BRIGHT NICKEL PLATING SOLUTIONS have been improved and wide substitution of dull nickel solutions by bright nickel solutions has occurred. Bright nickel solutions were discussed by Green[22], Soderberg[23], and Overcash[24], and automatic bright nickel and chromium plating was discussed by Kronsbein[25].

WETTING AGENTS[26] have become more widely used for control of pitting in nickel plating solutions. The securing of ADHERENT NICKEL and chromium coatings on TIN PLATE has always been difficult and a notable contribution to this problem has been made by Hothersall and Leadbeater[27].

Wesley[28] pointed out that electrodeposition of HEAVY NICKEL

COATINGS could be viewed as a cold casting process capable of producing metallurgically sound nickel with excellent physical properties and hence nickel can be used for building up worn deposits without sacrificing physical properties.

The developments in CHROMIUM PLATING were chiefly of application. Contributions to the study of the STRUCTURE OF CHROMIUM deposits were made by Cymboliste[29]. BASKET CHROMIUM PLATING of small articles was discussed by Ingersoll[30] and chromium plating in the printing trades by Dobbs[31].

ZINC PLATING was characterized by a very extensive use of bright zinc solutions and expansion of high speed plating processes. Investigations in bright zinc plating were reported by Young[32], and Spears[33].

Nineteen thirty-eight was one of the most productive years for research on SILVER PLATING SOLUTIONS. Wood[34] discovered that sodium cyanide silver solutions containing 16 ounces per gallon of potassium nitrate were superior to the usual potassium cyanide solutions.

Egeberg and Promisel[35] found that thiourea and certain dithiocarbamates are excellent BRIGHTENERS FOR SILVER SOLUTIONS. Johnson and Mathers[36] studied the CO-DEPOSITION OF VARIOUS METALS such as nickel, cobalt, cadmium, and copper with silver, and Thurber, Gray and Sholtz[37], the CORROSION OF SILVER ANODES. Other contributions to silver plating were as follows: ALLOYS OF SILVER AND IRON by C. G. Fink and V. S. de Marchi[38]; the ELECTRODEPOSITION OF SILVER FROM SOLUTIONS OF SILVER NITRATE IN THE PRESENCE OF ADDITION AGENTS by R. Taft and L. Horsley[39]; SILVER PLATING FROM ACID COMPLEX iodide baths by D. K. Alpern and S. Toporek[40], and THE ADHERENCE OF THICK SILVER PLATE ON STEEL by F. C. Mathers and L. I. Gilbertson[41].

Several publications have treated the subject of COATING METALS WITH ALUMINUM. Fink[42] published a method of producing ductile aluminum-coated steel by a hot dipping process. THE MARTIN[43] PROCESS, still in the experimental stage, was reported and it utilizes chemical reactions between the metal surface and a volatile salt of aluminum, usually the halogen. Aluminum may be deposited upon iron in a reducing atmosphere containing aluminum chloride at 750° to 1100° C.

Wider application of the Travers method[44] of PLATING UPON ALUMINUM and continued use, especially in Europe, of the sodium zincate pre-dip was made in 1938. Articles on ANODIC OXIDATION of aluminum have been many[45].

Two new methods of producing PROTECTIVE COATINGS UPON ALUMINUM have been described, one of which involves the electrolytic treatment of aluminum or its alloys in aqueous solutions of titanium salts[46]. A strong tightly adherent, highly corrosion - resistant opaque layer is formed. The other method[47] of protecting aluminum or its alloys involves their immersion into sodium silicate solutions.

Research on ALLOY PLATING involved a study of a white brass (copper-zinc) solution by Oplinger[48], the electrodeposition of ternary copper-nickel-zinc alloys by Faust and Montillon[49], and cobalt-nickel alloys by Weisberg[50].

Several noteworthy contributions were made to the subject of PURIFICATION OF SOLUTIONS one of which was the method of removing sodium carbonate from cyanide plating solutions by the use of gypsum[51] (calcium sulphate). Hull[52] continued the study of gypsum in cyanide plating solutions in his studies of the effect of carbonates and sulphates upon the operating characteristics of cyanide plating solutions, giving the effects of sodium carbonate and sodium sulphate on the viscosity and resistance of plating solutions.

Mattacotti[53] summarized the effects of METALLIC AND ORGANIC IMPURITIES in plating baths with a discussion of four methods of purification, namely: (1) Liscomb method, (2) plating out, (3) hydrogen peroxide and (4) activated carbon and filtration. A notable advance in 1938 in the TREATMENT OF SOLUTIONS was the use of activated carbon[54] for removal of organic impurities and filter aids[55] for increasing the speed of filtration.

The work of Pinner and Borchardt[56] on ANODE CORROSION was an outstanding contribution to this subject. They showed that the formation of loose nickel particles was influenced by the chloride content of the nickel solution with a high amount of particles forming with nickel chloride contents above 12 ounces per gallon. They also showed that the amount of loose particles was greater with low current densities (5 amperes per sq. ft.) than with high current densities (40 to 100 amperes per sq. ft.).

In COLORING OF METALS, the trend has been towards the production of more stable coatings. Methods for coloring cadmium deposits in oxidizing solutions have been developed by Erskine[57] and various iridescent colors have been reported possible from molybdenum-sesquioxide solutions by Krause[58]. Hogaboom[59] presented a noteworthy resume of coloring processes at the annual convention of the American Electro-Platers' Society in Milwaukee.

The troublesome problem of PLATING UPON STAINLESS STEEL has been solved by Wood[60] and Shirley[61], the latter reporting that it is possible to obtain adherent deposits of copper from acid copper baths by previous cathodic treatment in sulphuric acid.

A volumetric process for the DETERMINATION OF COBALT AND NICKEL in the presence of one another, was reported by Evans[62]. Numerous workers[63] were engaged in the testing and development of MAGNETIC METHODS FOR DETERMINING THICKNESSES of plated coatings. Magnetic methods are being more widely used due to the rapidity with which measurements can be made and the non-destructive nature of the tests.

STRIPPING METHODS FOR DETERMINING THICKNESS of chromium plate using hydrochloric acid solutions have been investigated by Clarke[64], and Pinner and Sperry[65], who determined the effect of temperature on the rate of solution of the coating in the acid. Ballay[66] reported his research on a drop test for determining nickel coatings, using a mixture of nitric and sulphuric acids.

Miscellaneous interesting uses for electroplating were: A METHOD FOR MAKING NON - FERROUS SCREENS BY ELECTRODEPOSITION[67]; GALVANOPLASTIC REPRODUCTION FROM METAL MOLDS by George Schor[68], and METAL PICTURES BY ELECTROPLATING by Charles P. Treppe[69].

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A Review of Hot Galvanizing in 1938

By Wallace G. Imhoff

President, The Wallace G. Imhoff Co., Vineland, N. J.

There has been much interest during 1938 in the most vital and important problems of the galvanizing industry and these problems have been subjected to extensive research investigations. The painting of hot-galvanized iron and other zinc coatings has been given much attention. Several commercial treating solutions, primers and paints have appeared on the market for this purpose. The Cronak treatment of the New Jersey Zinc Company was more widely used. The American Hot Dip Galvanizers' Association, Pittsburgh, Pa., published a circular entitled, "Treatment of Galvanized Surfaces to Prepare Them for Painting," which deals with commercial primers for galvanized iron; formulae used to pre-treat galvanized iron before painting and a list of paint manufacturers who furnish pre-treatments for zinc surfaces and paints for zinc surfaces.

The serious problem of treatment of spent pickle liquors has been studied actively again and research fellow-

ships established for its study. The disposal, recovery and treatment of spent pickle liquors are discussed in circular No. 2 of the American Hot Dip Galvanizers' Association. Standard specifications have been prepared for the hot dip galvanizing of steel window sash as the use of hot galzanized window sashes for industrial building has increased widely during 1938.

Other developments in hot dip galvanizing have been the Wheelabrator for cleaning of castings, improvements in cleaning, pickling and galvanizing of strip steel and progress in the engineering of hot dip galvanizing furnaces. Particular effort has been made to keep the alloy iron-zinc layers thinner.

The Galvanizers Committee sponsored by the American Zinc Institute and the American Hot Dip Galvanizers' Association have been active, with the former committee holding two meetings. The Hot Dip Galvanizers' Association has been active in the dissemination of specification folders, solution of pickling problems in zinc coatings and in the advertising of the value of heavy zinc coatings for protection of iron or steel.

During 1938 there were two important contributions to the technical literature on hot dip galvanizing, (1) a book, "Hot-Dip Galvanizing Practice" by W. H. Spowers, Jr., and the other contribution was a series of fifteen articles by Wallace G. Imhoff, which cover in detail every field of hot dip galvanizing.

Hot-Dip Galvanizing Steel Window Sash.
(Courtesy of San Francisco Galvanizing Works, San Francisco, California.)

Developments of 1938 in Supplies and Equipment for Plating and Finishing

Metals and Alloys

SHEET STEEL—The installation of continuous mills has resulted in sheets far superior to those produced by older methods and in addition these new mills have been largely responsible for lowering sheet prices. The purchase of steel in coils wherever possible has resulted in lowering handling costs and less scrap particularly in length. Improvements for cold finishing include changes in pickling and cleaning practices, rubber, brass or composition rolls, and belts to prevent handling marks.

ZINC—Zinc alloy die castings were used in increasing quantities and diversity of applications. The automotive industry consumed about 50% of the total castings produced. Soundness of castings is being improved by controlled die temperatures maintained by balancing the speed of operation against the devices for cooling the dies.

A third Zinc alloy (No. XXV) has been added to the two standardized in 1934 under the guidance of Committee B-6 of the A. S. T. M. There has been a tendency to eliminate the 3% copper alloy by the more stable alloys with less copper. The die casting industry has been the major outlet for Special High Grade zinc (99.99+%) which has been available from three producers. Use of the 1% copper-zinc alloy in the rolled form has gradually increased.

NICKEL—The world consumption of nickel in all forms during the first 10 months of 1938 decreased about 16% from the 1937 record, largely due to the abrupt drop in business in the United States. Pioneering in new uses of nickel and its alloys cushioned the fall in total consumption of the metal.

The uses for nickel during the year were as follows:—steel 60%; nickel-copper alloys and nickel silver 14%; Monel, Malleable Nickel, Nickel Clad, Inconel 9%; Electroplating 6%, and Miscellaneous 11%.

Important developments in stainless steel have been made with the additions of titanium, columbium and molybdenum. The first two improve resistance to intercrystalline deterioration and ensuing corrosion; in consequence the welding of stainless steel is now an easier problem to handle.

Molybdenum improves the standard 18-8 stainless steel and increases its corrosion resistance. Its use as an auxiliary alloying element in chromium and nickel is growing rapidly.

There has been an increase in the use of nickel austenitic steels in the automotive industry for exhaust valves, the nickel content ranging from 8 to 20 per cent, and 14 per cent nickel being a favored composition.

In special cases, the thickness of nickel plating has been increased as much as 50 per cent. The bright plating process has been widely adopted, notably for automotive hardware.

Increasing quantities of stainless steel were used not only for lightweight, high-speed trains to be operated as integral units, but also for separate cars which can be used interchangeably with standard equipment. This alloy is sometimes employed for the streamlined sheathing on converted motive power.

Nickel has always been the fundamental alloying element for steels subject to wear, as well as for highly stressed parts of aircraft engines. This role continues unchanged. Straight nickel steels and nickel-chromium, nickel-molybdenum and nickel-chromium-molybdenum steels with nickel contents up to five per cent remain the standard materials for gears, connecting rods, crankshafts, cam rings, piston and knuckle pins, rollers, studs, bolts, nuts, roller bearings, shafting and numerous other important parts. The use of these materials not only assists manufacturers to obtain reliability but also makes possible low weight-to-horsepower ratios without sacrifice of safety.

The year has witnessed steady progress in the application of the 18-8 type of chromium-nickel stainless steel to the structural parts of aircraft. Numerous complete wings, tail structures, wing flap assemblies, wing ribs, pontoons and similar parts have been built both experimentally and in regular production.

An alloy with constantly broadening uses in modern marine construction is a cupro-nickel combination containing 70 per cent of copper and 30 per cent of nickel. First, introduced as the material for condenser tubes, this alloy is now being extensively adopted for pipe lines handling sea water for flushing, fire and sanitary services as well as for drain pipes.

Drawn shapes have been made from nickel plated strip to prevent scaling when annealed, and plating has been used on iron and steel to prevent rusting during storage and assembly. Nickel is used in these cases to reduce operating costs with no thought of its decorative effect.

Builtup deposits have become commercial practice in England and are finding a place in the United States for the first time. Hard, abrasion and corrosion resistant nickel deposits are quite common in dies, rolls, and other abrasion resistant machinery. Producers of such deposits have found that nickel furnishes them with a new finish which is cheaper than chromium. While the hardest nickel is softer than chromium, laboratory tests have shown that its physical properties can be controlled, and the toughness and ductility of the softer deposits are being used.

ALUMINUM—The year 1938, as far as the aluminum industry is concerned, may be classified as one of those "in-between" years. Although production was below the abnormal high of 1937, it can be considered as an average year. Improvements in general business during the last three months point the way toward a good year in 1939. Specifically encouraging signs are the new aircraft building program, enhanced use of aluminum in the marine industry, increasing numbers of unfilled automobile orders and extensive rural electrification plans.

Improvements have been made in both military and transport planes, and the arrival of the superplanes is being watched with interest. Use of reliable, light aluminum alloys in aircraft constructions, including the airplane proper, the power plant and the propellers, makes possible the outstanding performance shown in present-day models.

With constantly increasing numbers of unfilled orders in the automotive industry, 1939 gives every indication of exceeding the year just closed in automobile production. This increase will mean more business for aluminum fabricators in the manufacture of pistons, cylinder heads and other automobile parts.

New equipment placed in service in the railway field included the 50 all-aluminum street cars built for the Third Avenue Railway in New York. Also built of aluminum in 1938 were 40 locomotive cabs of the New York Central, each effecting a 3000-pound reduction in weight, and the nosepieces of a number of streamlined locomotives of the same railroad. A new development was the use of aluminum forgings for locomotive crosshead slippers, which greatly reduce rail pounding.

Aluminum tank cars have been in service for years, but within the past year the use of these cars for the transportation of dangerous and inflammable materials was approved by the Interstate Commerce Commission.

With accelerated construction of rural electrification lines, aluminum cable, steel-reinforced, continues its popularity and today more than 700,000 miles have been manufactured for use in the United States.

FINISHES ON ALUMINUM—More aluminum was finished by electrolytic processes during the past year than in any other previous similar period.

Alzak reflectors and lighting fixtures of aluminum increased in popularity during the past year.

Tabulating the total by weight, Alumilite and Alzak finishes, two important electrochemical treatments for aluminum, have accounted for a 25 per cent increase over 1937, while the general production of aluminum lagged behind.

The 1938 expansion occurred largely in the architectural field, where aluminum window frames for residences came into prominence during the past year. In many instances these frames were finished by the Alumilite process. Aluminum weather-stripping, finished in the same manner, may be a major production item in the coming year.

A beautiful golden color for Alumilite coatings has been obtained by the proper blending of various colors of the spectrum. It is expected that this new color will enlarge the field for coated aluminum, particularly if applied to novelties and accessories.

Refrigerator parts utilize the decora-

tive and serviceable properties of colored aluminum coatings, which have also found acceptance in the slide fastener industry, where fasteners of many hues are desired. Comptometer parts have recently been given Alumilite coatings to give them added resistance to abrasion.

The finish applied on Alzak reflectors is finding wide commercial application, both for interior and exterior lighting service. Alcoa lighting sheet, a commercial product provided with this type of finish, is increasing in popularity. It is used chiefly for the construction of trough-like lighting reflectors.

Relatively new is the Alrok aluminum finish, now being used as a corrosion-resisting finish for the interior and exterior of airplane gasoline tanks and as a surface preparation for paint finishes on outboard motors. This finish, in contrast with those just mentioned, is chemically applied, therefore requires less equipment. There are several such coatings available, depending upon the properties desired, and they range from yellow coatings, primarily for corrosion resistance, to white non-smudging coatings, employed mainly for the attractive finish.

PLATINUM METALS — World production of the platinum metals in 1938 is estimated at 460,000 ounces, due principally to increases in Canadian and United States output. This total compares with approximately 440,000 ounces in the previous year.

Reduced demand from the jewelry industry and the absence of purchases by various governments were offset by the encouraging increase in the use of dental gold alloys and in the attention which was given to platinum and platinum-clad as materials for construction in the chemical industry.

This latter development is due to the emphasis on research in the industrial uses of platinum and to the further improvement in the technique of producing platinum-clad materials which combine exceptional corrosion and oxidation resistance with the strength and economy of the cheaper metals. Platinum and platinum-clad materials are becoming available for applications previously deemed beyond the practical economy of industrial use. Examples are evaporators for caustic and other products, agitators, tubing for conveying corrosive liquids and liners for autoclaves.

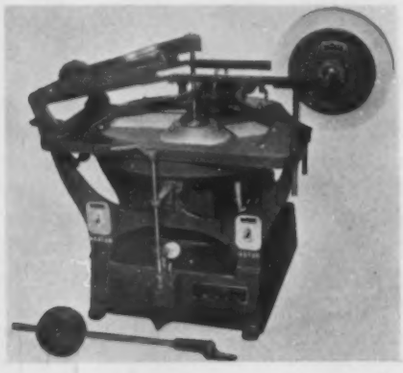
Palladium and palladium alloys continued to be used in telephone equipment for relays, dialing units and other contact requirements in telephone service.

In the jewelry field, platinum retained its place as the most desired metal in which to set diamonds.

Grinding, Polishing and Buffing

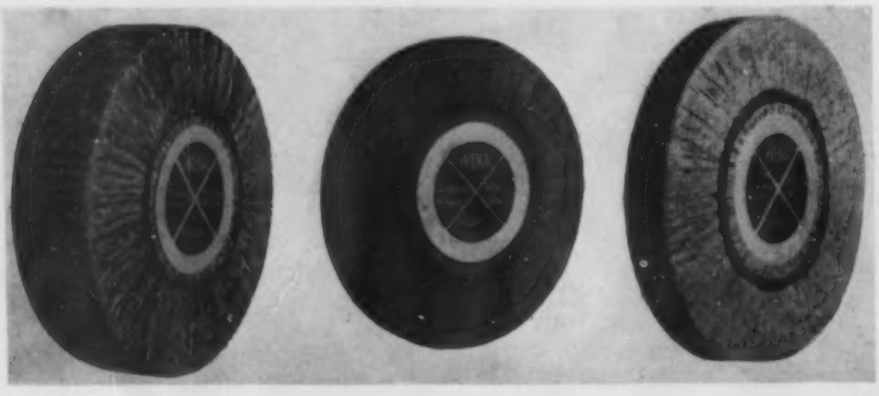
Double Arbor Polishing Lathe. Each spindle is driven by independent motor. Accommodations for 4 men.

(Crown Rheostat and Supply Co., Chicago, Ill.)



Wheel Heading Machine No. 2-Hydraulic. A machine designed for quickly applying abrasive grains to polishing wheels in conjunction with glue or cement.

(Divine Brothers Co., Utica, N. Y.)



Grinding and Polishing Wheels. Wheels are made of cotton, wool, or leather, depending upon the work to be polished.

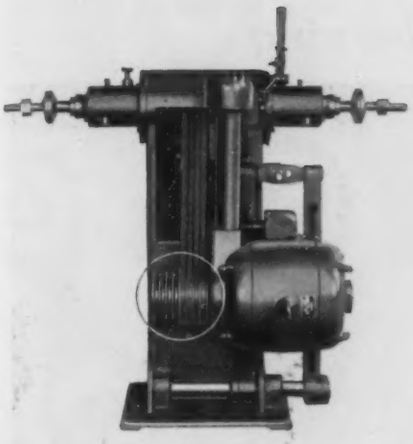
(Weigert and Spector, N. Y. City)

Special efforts have been made to produce abrasives for polishing that would eliminate wheel glazing or "loading" which have become available in grit sizes from No. 20 to 90 inclusive[1]. Improvements have been made in the strength of the grains of silicon carbide abrasive, resulting in faster cutting ability as a result of the sharpness of the grain.[2, 3]

Two special cements have been developed for polishing wheels for which it is claimed that difficulties from non-uniformity such as are experienced with glue, are obviated.[4, 5]

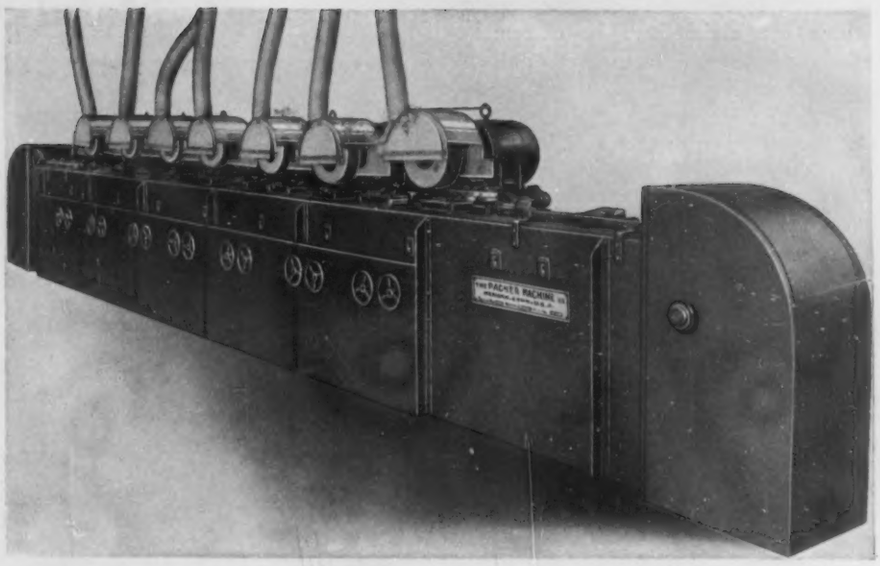
The new polishing methods developed during the year featured increased accessibility with longer overhang[6], variable speeds[7], special safety features[8] and double spindle machines. Developments in automatic polishing and combinations of automatic polishing and buffing are shown in the illustrations. Developments in polishing wheels include wheels using sisal or similar fibre as basic raw material[9], and wheels with special wire mesh centers[10] to accomplish automatic centering and balancing with a corresponding decrease in pressure required.

New types of polishing dust collectors have been marketed[11]. Fully automatic barrel methods have been developed for cutting-down burnishing, coloring and high glossing[12]. In addition a special bright burnishing compound has been offered to the trade which will produce a very high



Two Speed Polisher. Change of speed is effected easily by adjusting the position of the motor.

(Hammond Machinery Builders, Kalamazoo, Mich.)

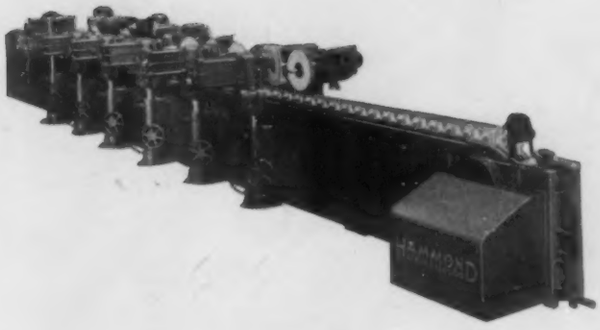


Automatic Polishing and Buffing Machine. Wheelheads can be adjusted from horizontal to vertical and they are arranged with spring balance plates. All working parts shielded against dust.

(The Packer Machine Co., Meriden, Conn.)

New Buffing Lathe. Motor in the base polishing and buffing lathe for general application in the slightly heavier fields.

(Divine Brothers Co., Utica, N. Y.)



Automatic Polishing and Buffing Machine. Has 12 heads separately powered and balanced insuring uniform wheel pressure. Heads adjustable from horizontal to vertical wheel positions.

(Hammond Machinery Builders, Kalamazoo, Mich.)

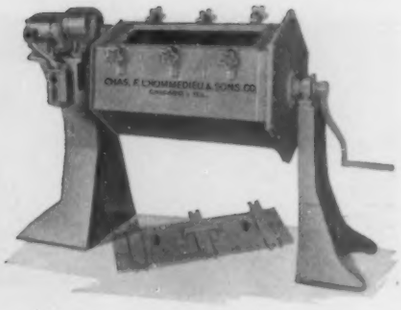
lustre on metal stampings and cuts the surface of the metal down sufficiently to bring up a uniform and scratchless finish. Automatic separation of burnishing balls from[13] the work is offered in a new burnishing barrel and a combination washing, ball separating, rinsing machine with continuous sawdust drying has been made. This type of machine is ideal where a large amount of burnishing is done in small batches.

Designers of tumbling barrels have attempted to produce more efficient tumbling actions in the barrel and this has resulted in a triple action tumbling barrel in which the material undergoes an over and over, end to end and folding-in motion combined[14].

Developments in buffing wheels have included construction to allow better ventilation[15, 7] and the development of buff sections made of

The above drawing shows the triple action obtained in a new cutting barrel.

(The Hartford Steel Ball Co., Hartford, Conn.)



Tumbling and Burnishing Barrel. New barrel for tumbling, ball burnishing, etc. of very sturdy construction.

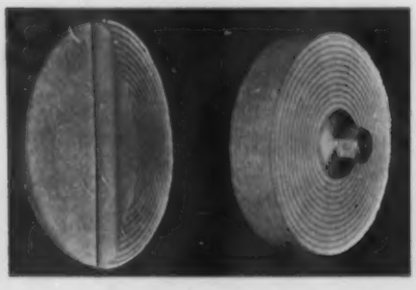
(C. F. L'Hommedieu & Sons Co., Chicago, Ill.)

alternate layers of sisal and muslin which are claimed to be extremely effective for operations between polishing and buffing.[9, 16]

1. General Abrasive Company, Inc., Niagara Falls, N. Y.
2. Norton Company, Worcester, Mass.
3. Carborundum Company, Niagara Falls, N. Y.
4. Harrison & Company, Haverhill, Mass.
5. J. J. Siefen Company, Detroit, Mich.
6. Crown Rheostat & Supply Company, Chicago, Ill.
7. Chas. F. L'Hommedieu & Sons Co., Chicago, Ill.
8. Frederic B. Stevens, Inc., Detroit, Mich.
9. Divine Bros. Company, Utica, N. Y.
10. Ever-Tru Abrasive Wheels, Inc., New York City.
11. Leiman Bros., Inc., Newark, N. J.
12. Lupomatic Tumbling Machine Company, New York City.
13. N. Ransohoff, Inc., Cincinnati, Ohio.
14. The Hartford Steel Ball Company, Hartford, Conn.
15. MacFarland Manufacturing Company, Long Island City, N. Y.
16. Hanson - Van Winkle - Munning Co., Matawan, N. J.

Table Buffing Machine. New flat stock buffing machine for surface finishing metallic and non-metallic sheets, plates, and slabs.

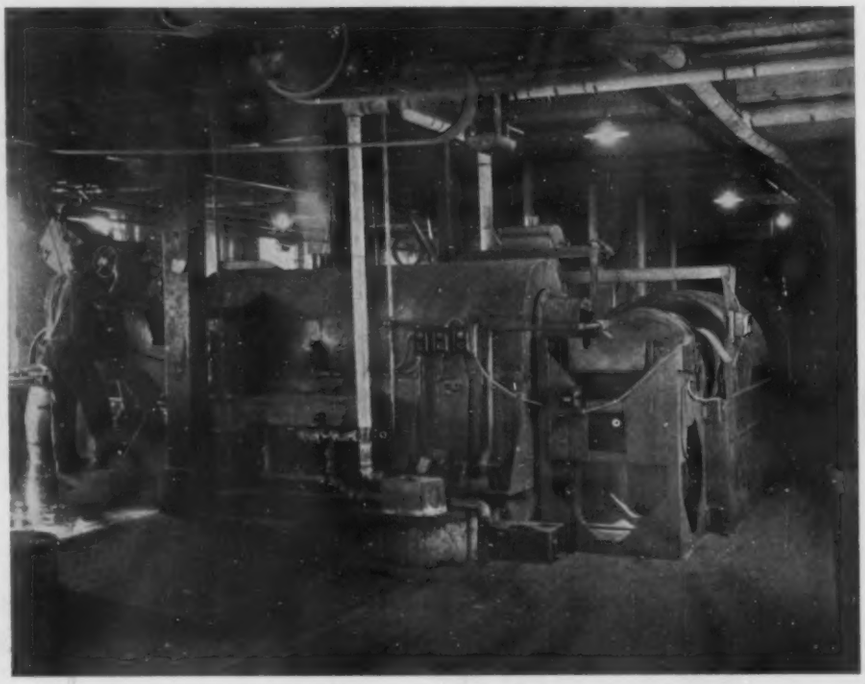
(Munning and Munning Inc., Newark, N. J.)



Sisalin Sections. Buffing wheel sections of sisal, a tough fibre, alternated with muslin. Used for heavy cut-down buffing.

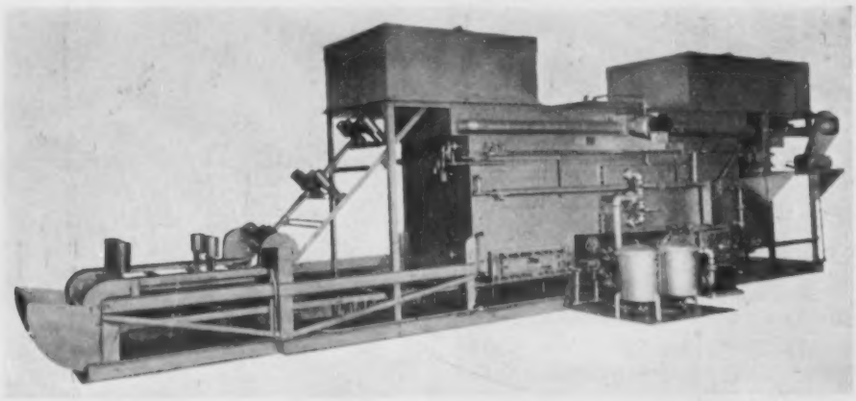
(Hanson-Van Winkle-Munning Co., Matawan, N. J.)

Metal Cleaning



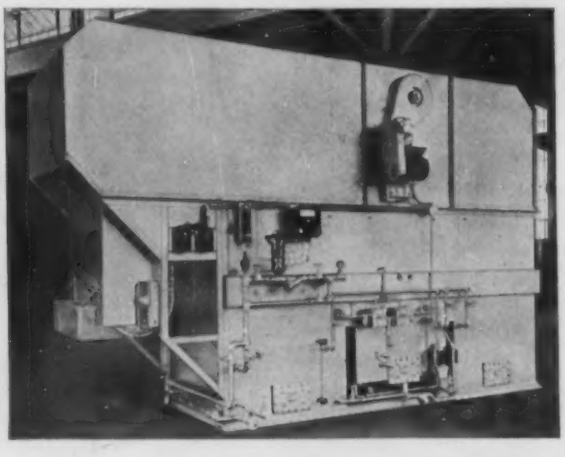
A combination washing, ball separating and rinsing machine with a continuous sawdust dryer. Separates balls from work and washes them.

(N. Ransohoff, Inc., Cincinnati, Ohio)



Vapor-Spray Degreaser. Parts are held rigid and carried through hot solvent vapors and spray. Has special filter, removable steam coils and quick-opening cleanout door.

(G. S. Blakeslee & Co., Chicago, Ill.)

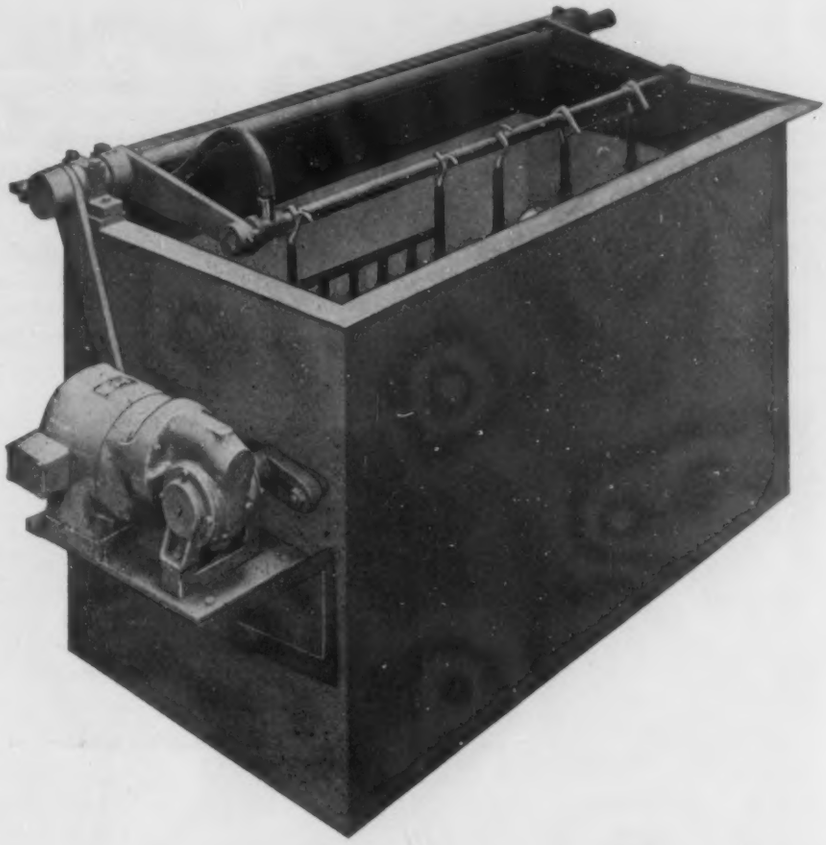


Automatic three-dip type degreaser equipped with cross-rod conveyor, automatic controls, and arranged for loading and unloading at one end.

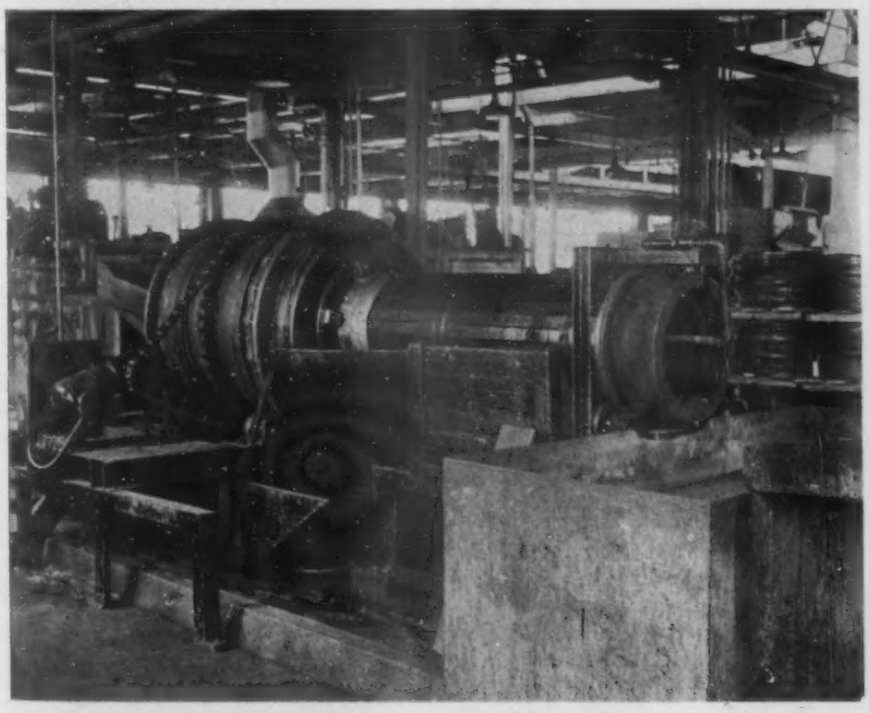
(Detroit Rex Products Co., Detroit, Mich.)

The cleaning developments during the year were largely for special applications and anodic cleaning[1] particularly for cleaning of cold rolled steel with attendant removal of smut has increased. The rapid plating of steel strip necessitated the development of rapid cleaners[2, 3] which would be capable of cleaning steel strip running at speeds up to 1500 ft. per minute. This has been accomplished.

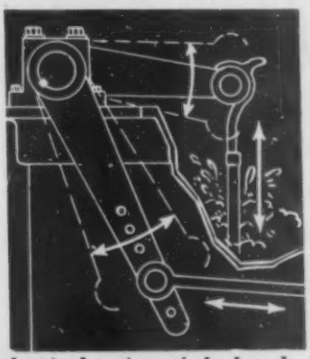
Due to the increased use of full-automatic nickel and chromium plating, cleaners often have become contaminated with chromic acid. Heretofore when the chromic acid contamination reached a point of 1 ounce of chromic acid to each 1500 gallons of cleaning solution, a chromate film was formed on brass which prevented adhesion of the subsequent nickel plate. A cleaning composition has been designed[4] to provide for adequate cleaning and to withstand as high as forty times the chromic acid contamination formerly possible without affecting the working efficiency of the solution. The improvements in alkaline cleaners have, in many cases, permitted efficient cleaning to be obtained with concentrations as low as from 1½ ounces to 3 ounces per gallon[2]. The extensive use of bright nickel plating has accelerated the production of special cleaners to secure good adhesion and smut-free surfaces. This has been



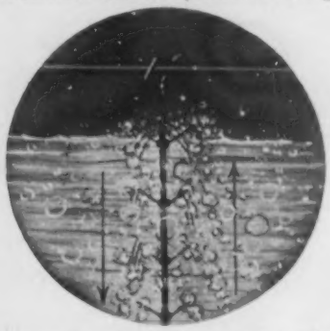
New Slusher for Speeding Cleaning Process. The cleaning bar is mechanically raised and lowered to markedly increase cleaning action. Unit can be provided with electrical connections for electrocleaning.
(The Belke Mfg. Co., Chicago, Ill.)



Batch Pickling Unit. For pickling small parts after heat treating or before plating or galvanizing. A stream of acid is pumped over the work while it is being agitated in drum.
(N. Ransohoff, Inc., Cincinnati, Ohio)



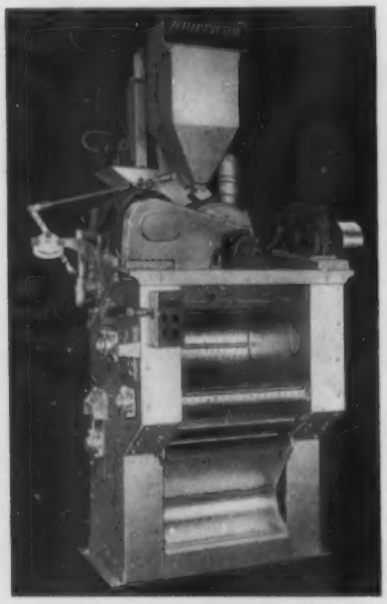
Mechanical action of slusher design.



Pieces to be cleaned are suspended on the cross bar and the dirt is slushed off by means of the up and down motion.

accomplished by anodic cleaning[1]. and by anodic and cathodic cleaning[2]. The problem of cleaning steel and brass in the same solution using reverse current has been solved[6] so that it is possible to clean steel and brass together without attacking the brass. Steel and buffed copper have also been cleaned together in full-automatic equipment with cleaning solutions operating at high temperatures[6].

The developments in solvent cleaning and degreasing have been largely



Wheelabrator Tum-Blast. An airless centrifugal blasting unit for abrasive cleaning of castings, springs, heat-treated parts, stampings, etc.

(The American Foundry Equipment Co., Mishawaka, Ind.)

in the combination of spray cleaning, immersion solvent cleaning, and vapor cleaning. Special degreasers have been built combining solvent immersion with a vapor spray for the removal of buffing rouges, oils and greases[7]. Many installations of three tank degreasing using hot solvent wash, cool solvent rinse followed by a second rinse of hot clean vapors, have been installed.[7, 8]

1. MacDermid, Inc., Waterbury, Conn.
2. E. F. Houghton & Company, Philadelphia, Pa.
3. Hanson-Van Winkle-Munning Company, Matawan, N. J.
4. Oakite Products, Inc., New York City.
5. Frederick Gumm Chemical Company, Inc., Kearny, N. J.
6. J. B. Ford Company, Wyandotte, Mich.
7. G. S. Blakeslee & Company, Chicago, Ill.
8. Detroit Rex Products Company, Detroit, Mich.

Generators

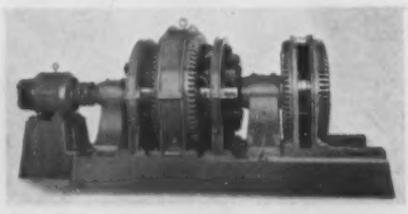
Difficulty with the current density varying with the amount of work in the plating tank has been overcome by a line of generators which maintains constant current density with wide variations in load[1]. Thus, if the amount of the work in the tank is suddenly doubled, the amount of amperes flowing from the generator to the work will be automatically

Front view of control panel for the motor-generator set for anodic oxidation of aluminum.

(Hanson-Van Winkle-Munning Co., Matawan, N. J.)

doubled. This automatic current control is accomplished by the use of a synchronous driving motor which maintains absolutely constant speed under all conditions of load. In the second place, it is obtained by a flux diversion between the interpole and the main poles of the generator.

A new type of controller has been



Generator which maintains constant current density with varying loads.

(The Electric Products Co., Cleveland, Ohio)

designed for use with low-voltage high-amperage generators where very close control of the voltage is required. This controller is particularly designed for laboratory use and it replaces the standard field rheostat and separate exciter. For example, on a 6-volt generator where voltages from 0 to 6 are required, this controller will enable the operator to set the voltage at any point within 1/10th of a volt[2].

During the course of the year low voltage generator sets were installed with automatic voltage control for the anodic treatment of aluminum[3]. The automatic control devices varied the generator voltage through a pre-determined cycle of values. For example, from 5 to 40 volts in a period of 8 minutes and then maintenance of 40 volts over a short period of time.

Brushes for plating generators have received much attention[4], and copper-graphite brushes have been developed which have low contact drops and excellent commutating characteristics[5]. In addition, the graphite serves as a lubricant and actually polishes the

Copper oxide rectifier installed in an electrotyping plant.

(Hanson-Van Winkle-Munning Co., Matawan, N. J.)

commutator while the set is in motion, thus reducing wear and prolonging the life of both the brush and the commutator. Improvements were made in 1938 in the copper oxide plate rectifier for providing current for electroplating[3]. New types of plates were installed which raised the efficiency of the rectifier plates.

1. Electric Products Company, Cleveland, Ohio.
2. Columbia Electric Manufacturing Company, Cleveland, Ohio.
3. Hanson-Van Winkle-Munning Company, Matawan, N. J.
4. Speer Carbon Company, St. Marys, Pa.
5. Ideal Electric & Manufacturing Company, Mansfield, Ohio.

PLATING TANKS

By J. D. Tierney

Storts Welding Co., Meriden, Conn.

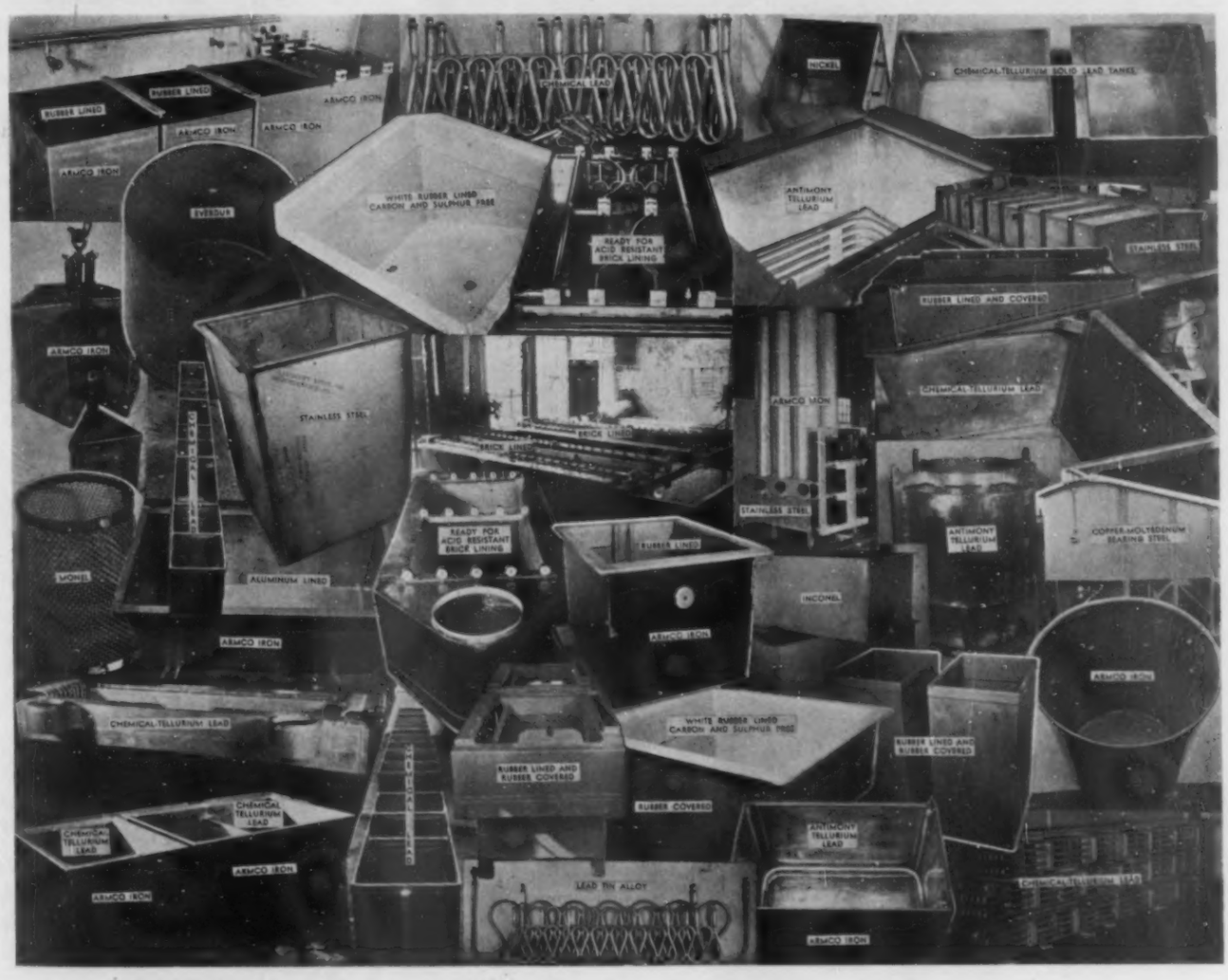
Whereas in 1935, 1936 and 1937, inquiries and orders for metallic and non-metallic corrosion resisting materials were occasional, the demand in 1938 for these grades of materials showed a great expansion. Negotiations and transactions in some cases showing increases of more than a hundred-fold over the aggregate amount bought and used in the three previous years.

In the category of non-metallic corrosive resisting materials, rubber-lined (only) and rubber-lined and covered tanks, exhaust casings, piping, agitating equipment, plating racks and plating barrels were only a few of the many items utilized, on a "long-range" cost cutting plan designed to resist corrosion for many years, in general, for ten years and more.

Rubber compounds, adapted to corrosive resistance problems, for which it is suitable, has already proven itself practical and economical for the past ten years. While this proving period has had its course, research has resulted in greatly improving the compounds with the result that applications of today, under favorable conditions, promise a vast increase in duration of the life of the coatings.

Among other non-metallics, some of the synthetic compositions received good recognition and demand for resistance to nitric acid and other combinations of acids. The higher initial cost is proving a "low cost" when "long-range" cost cutting plans are employed. Industry during 1939 will do well to become more familiar with the results obtained during 1938 in the use of these synthetic non-metallic compositions.

Brick linings (often referred to as chemical stoneware) also increased in demand during 1938. This was specially notable in chromium plating



Materials used for making tanks and equipment in 1938.
(*Storts Welding Co., Meriden, Conn.*)

tank installations where brick linings (not slab linings) have proven so utilitarian and economical in general use for the past several years. An initial brick lining installed eight years ago is still doing a first class job of resisting corrosion of chromium solution and appears at least 90% capable of doing the same service for no less than eight years more.

In the metallic classification of special corrosive resistant materials, stainless steel was a foremost contender during 1938, for treating with corrosion. Its increased use for resistance to chemical corrosion and also for resistance to oxidation at high temperatures was very notable and outstanding in the year's events.

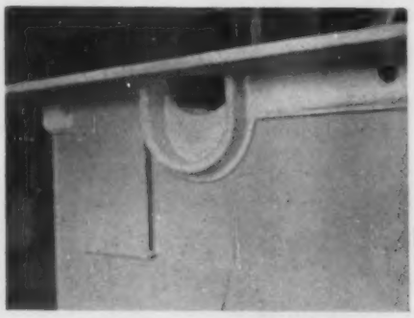
Metallurgists discovered a powerful "punch" to add to stainless steel's defensive capacity when they discovered that inclusion of a small percentage of titanium or columbium in the base or parent metal and welding rods would greatly retard and control undesired conditions of carbide migration (oft-times referred to as carbide precipitation or carbide segregations), which formerly occurred because unavoidable and necessary temperature conditions, adjacent to the point of fusion, allowed for carbide migration during the process of welding procedure and control.

Titanium in the base metal and columbium in the welding rod, to control carbide movement, were instrumental in the success of fabricated stainless steel for corrosive solutions.

Stainless steel's high tensile strength allows for a decrease in plate and sheet thickness on tank and other fabrication requirements and hence, on "long-range" cost-cutting plans, fills the need for defeating corrosion economically. 1939 will see it go proportionately farther than it has heretofore. In fabricating shops, large and small, each work day of 1938 (except, of course, sit-down periods) found one or more of these special metals, in solid plate and sheet, or in clad form, being patterned and welded to the shape in which it could best serve to resist corrosion.

In the so-called "soft" metals field, the outstanding contribution to industry's combat with corrosion, during 1938, was the inclusion of tellurium in lead and lead alloys, for use as tanks, tank linings, coils and other fabrications. For two years, during 1936 and 1937, its forward movement was a gradual one, of deliberate slow steps to test and prove its value. 1939 will no doubt find it running along at a "double-time" pace and there is every good reason why it should. The remarkable characteristics that tellurium (in such small proportions as 1/10 of 1%) lends to chemical and antimonial leads, without affecting the pliability and malleability of ordinary lead to any great degree, is astonishing. Tensile strength values are greatly increased because the addition of tellurium reduces the normal coarse lead crystal structures to much smaller sizes. The finer-grain structures, in turn, furnish increased endurance and fatigue strength values, which have resulted in producing a lead structure that will improve with age-hardening and work-hardening and incidentally, offer higher resistance to corrosive elements, under most conditions.

In the lower-price non-ferrous metals category, with the addition of tellurium adding no more than ½ cent per pound to current lead market prices, it promises excellent utility and economy for those who will use it to combat corrosion's course.



New seamless rubber linings for plating tanks.
(Collord, Inc., Detroit, Mich.)

In the ferrous metals, specially designed for resistance to corrosion, Armco Ingot iron, Toncan copper, molybdenum-bearing steel and wrought iron held their respective places of prominence, during 1938, as corrosion's public enemies. While these metals are not a "rustless" approach to the subject of cutting corrosion costs, there always has been and always will be a popular demand for their use in industry because, each one, rightly applied, has the right properties for outlasting common steel and other comparable metals under like or nearly like conditions to the extent of proving at least two or three times more economical with the result that corrosion is held within bounds, to gains of 50 to 150%.

In addition to those metallics and non-metallics specially mentioned in this summary, it was not intended to slight or disregard the many other materials of comparable merit that are allied in the war on corrosion. There is no partiality designed in specially publicizing those mentioned because it is common knowledge that there is no "cure-all." Each material designed to help industry avoid high corrosion rates and corresponding high costs has its merits, its limitations and its special applications.

It was intended, however, to review and re-register the thought that Industry went a longer way with corrosion control in 1938 than it has in any previous year and that, unfortunately, due to unintentional lack of interest or because of oversight, the fact must be faced,—THAT THERE IS YET, A LONG WAY TO GO.

Numerous lining materials have been developed during the year for coating of steel and wooden tanks.[1 2 3 4] These materials are available in plastic condition for application by painting or troweling and can also be supplied in the form of sheet. A new material has also been developed which will withstand the action of oxidizing acids such as nitric acid as well as hydrofluoric acid, alkalies, hydrocarbons and most solvents. This material enables the production of lined steel tanks which can withstand the actions of combined nitric and hydrofluoric acids which are used in dipping of aluminum castings[4].

1. Heil & Company, Cleveland, Ohio.
2. Nukem Products Corporation, Buffalo, N. Y.
3. Collord, Inc., Detroit, Mich.
4. U. S. Stoneware Company, New York City.

Anodes

Developments during the year were chiefly on nickel anodes. A nickel anode containing a small amount of cobalt has been marketed to be used at high current densities. This anode is claimed to eliminate certain types of pitting which, in the past, have been prevented by the use of non-pitting agents[1]. A new rolled nickel anode of the carbon type has been developed containing about 0.25% carbon which is claimed to be particularly useful in low pH solutions, both hot and cold. The black carbon sludge forms a protective bag to prevent the transfer of metallic particles into the solution[1]. A 99% plus cast

nickel anode has been marketed for use in the hot Watts bath operated at pHs of 4.5 or lower. These anodes were designed especially for use in bright nickel plating. It is claimed that the anode operates with exceptionally high efficiency even at high current densities and due to the careful control of grain size, there is a minimum of loose nickel particles released during the plating process[2].

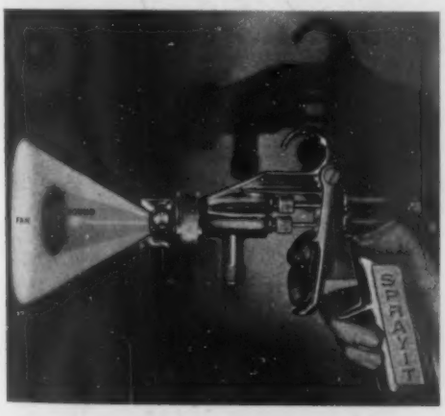
Glass cloth bags have been made available for plating which obviate rotting difficulties which are experienced with organic cloth bags.[1, 3]

1. Hanson-Van Winkle-Munning Company, Matawan, N. J.
2. The Seymour Manufacturing Company, Seymour, Conn.
3. Munning & Munning, Inc., Newark, N. J.

Glass Cloth Anode Bag.
(The Hanson-Van Winkle-Munning Company, Matawan, N. J.)

Lacquers and Enamels

The demand for "speed-up" finishing during 1938 resulted in the development of finishes with very short baking schedules. However, too short baking cycles at high temperatures are difficult to control to secure uniform results, and therefore, the present tendency has been to avoid extremely short schedules and adopt those combining speed with dependability. Many developments were made in finishing materials for special uses to withstand unusual conditions, such as finishes for air conditioning units, furnaces, salt water exposure, etc.

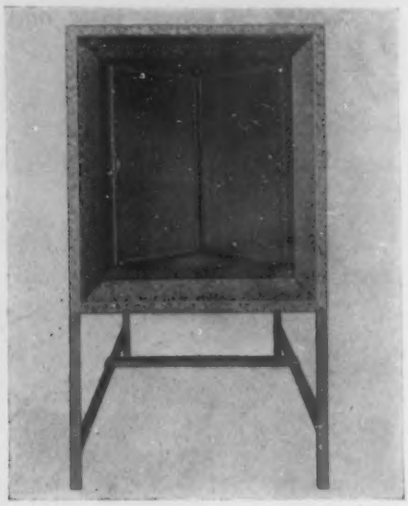


New Spray Gun. Will deliver a spray ranging from a wide fan to a round dot without stopping gun.
(The Electric Sprayit Co., Milwaukee, Wis.)

Some of the clear lacquers developed during the year included a clear baking lacquer which air dries in a short time, and after a moderate baking will stand blanking, forming, shearing and drawing[1]. A clear lacquer to withstand salt spray, humidity, sulphur contact and sulphur compounds[2], and a clear baking varnish, which is claimed to produce remarkably scratch resistant, pale, glossy clear finishes for nickel, chromium or electro-colored hardware[3]. A marked interest has been shown in transparent colored coatings, which reproduce the colors of copper, brass and other metal undercoats[4]. These coatings have greatly widened the field of usefulness of zinc die castings.

Combination Flock and Binder Booth. Binder is applied in right section and flock is applied and reclaimed in left section.
(Paasche Airbrush Co., Chicago, Ill.)

Wrinkle finishes have undergone very extensive improvements resulting in finishes which are uniform and capable of being repaired and which will withstand high humidity for long periods of time[2]. One manufacturer has developed a fine wave line wrinkle finish with glistening silver effects[5]. Wrinkle finishes are now available in white and pastel shades and these enamels bake hard and are wear-resistant and bake with a short baking schedule with almost no discoloration during baking[4].



Flock Spray Booth. Permits reclaiming sprayed material and prevents light material from scattering.
(The De Vilbiss Co., Toledo, Ohio)

Finishes to withstand severe corrosive atmospheres, such as acid and strong salt solutions, have been developed using chlorinated rubber[2], and a lacquer has been marketed to resist rust inhibitors and also will resist stamping, forming and other mechanical operations[4].

A new helmet type respirator especially adapted to overhead and outdoor paint spray work and protects head, neck and shoulders.
(The Binks Mfg. Co., Chicago, Ill.)

Some of the specialty lacquers developed during the year were perspiration-proof lacquers[4], heat-resisting paints capable of resisting up to 3000° F. for exhaust manifolds, furn-

A new roller type turntable to be used in a spray booth for rotating heavy objects in front of the spray operator.
(The Binks Mfg. Co., Chicago, Ill.)

ace castings, etc.,[6] and a heat resistant lacquer for nickel and chrome trim that is exposed to high temperatures (400° F.)[3].

Several porcelain-like synthetic enamels have been developed which are resistant to solvents, oils, greases, hot water and alkalies.[3, 5] A metal coating has been marketed for preventing adhesion of welding spatter[7], and metal wrap coatings which are applied to highly finished parts to protect them during shipment. These materials dry quickly and are removed by washing in common solvents such as kerosene or mineral spirits[7].

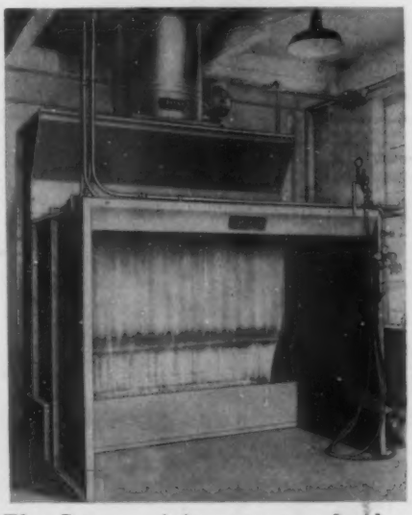
A primer for untreated Dow metal is now available[8], and a new stop-off lacquer with high resistance to alkaline cleaners has been offered to the trade[9]. Several basically new types of finishing materials have been developed during 1938, namely, the Duranite finishes which need only a short period baking[10], and methyl methacrylate clear resins which dry rapidly by evaporation of the solvents, giving films resistant to acids, alkalies and alcohol[11]. In addition, nitrocellulose lacquer emulsions have found use[12].

The quality of aluminum finishes during the year has undergone considerable improvement with the development of aluminum coatings with exceptional brilliance, good adhesion and wearing qualities which impart bright, smooth finishes in one coat[13].

Equipment for Lacquers and Enamels

Many new spray guns[14, 15, 16] have appeared on the market, possessing wide versatility. An interesting gun was developed for spraying heavy materials, such as asphalt paints and sound deadening materials containing sand or abrasives[17] as well as an extension handle for spray guns which facilitates spraying of difficultly accessible places[16]. For high speed automatic finishing of small and medium sized objects a rotary spray finishing machine has been manufactured capable of exceeding 3600 finished articles per hour[16].

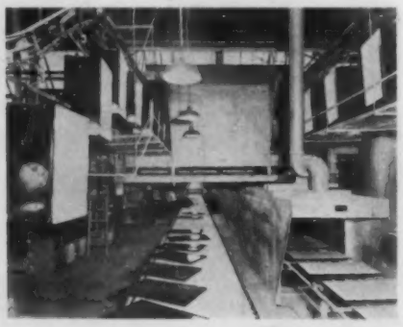
The design of spray booths has been in keeping with developments in finishing materials, and for example, flock spraying required the manufacture of specially designed spray booths.[14, 16] Greater attention has been given to the washing of lacquer and enamel spray with marked engineering developments in water-wash types of spray booths.[17, 18] The trend towards shorter baking finishes of synthetic enamels has necessitated new designs in baking ovens which would give uniform temperatures throughout the ovens, and this has been accomplished in part by re-circulation.[19, 20] Rapid strides have been made to make ovens safer and the net result is that today large gas-fired ovens may be started by remote control through a series of push button stations, all of



The Dynaprecipitor, a new development to take the place of the ordinary water-wash chamber for spray booths.
(The Binks Mfg. Co., Chicago, Ill.)

"Torrent Type" spray booth.
(The Newcomb-David Company, Detroit, Mich.)

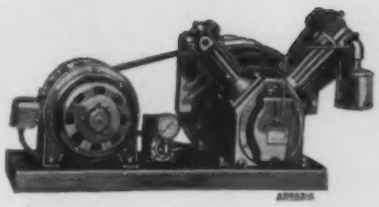
Tunnel Type Continuous Oven. Has special cross flow recirculating type ventilating system. Used for baking finishes on washing machines.
(Despatch Oven Co., Minneapolis, Minn.)



Continuous Conveyor Ovens.
(Despatch Oven Co., Minneapolis, Minn.)

which must be operated in a definite sequence to light up safely, and after the heaters are in operation any failure of the ventilation, power or pilot lights will cause an immediate shut down until the condition is remedied[19].

1. Agate Lacquer Mfg. Company, Long Island City, N. Y.
2. Roxalin Flexible Lacquer Company, Inc., Elizabeth, N. J.
3. Grand Rapids Varnish Corporation, Grand Rapids, Mich.
4. Maas & Waldstein Company, Newark, N. J.
5. Hilo Varnish Corporation, Brooklyn, N. Y.
6. K. Bader, Westmoreland Rd., London, NW 9, England.
7. Wayne Chemical Products Company, Detroit, Mich.
8. Watson-Standard Company, Pittsburgh, Pa.
9. Michigan Chrome Co., Detroit, Mich.
10. Zapon Division, Atlas Powder Company, Stamford, Conn.
11. E. I. duPont de Nemours & Company, Wilmington, Dela.



Industrial Air Compressor.

(Ingersoll-Rand Co., Phillipsburg, N. J.)

12. Hercules Powder Co., Inc., Wilmington, Dela.
13. Stanley Chemical Company, E. Berlin, Conn.
14. Paasche Airbrush Company, Chicago, Ill.
15. Alexander Milburn Company, Baltimore, Md.
16. DeVilbiss Company, Toledo, Ohio.
17. Binks Manufacturing Company, Chicago, Ill.
18. Newcomb-David Company, Detroit, Mich.
19. Young Brothers Company, Detroit, Mich.
20. Gehnrich & Gehnrich, Woodside, L. I., N. Y.

Lifting heavy rail with tank magnet which will lift 60 times its own weight.

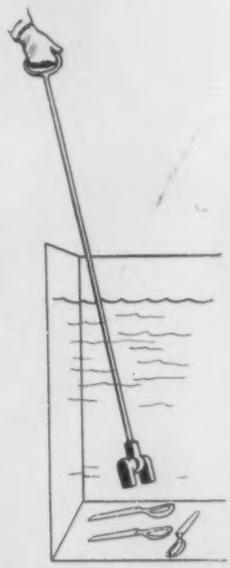
(The Belke Mfg. Co., Chicago, Ill.)

Miscellaneous Special Equipment

Various unique apparatus have been designed throughout the course of the year. A sawdust separator[1] has been developed in which the work mixed with the sawdust is put into the hopper, a button pressed and almost instantly a back and forth shaking action performs the separating job mechanically. The hopper has a screen bottom that can be changed to any mesh desired.

The need for agitating in bright plating and for plating at high current densities has resulted in the manufacture of agitators[2] for cathode rods. These agitators can be used for both single and double rods and have an adjustable stroke.

A steam-heated sawdust barrel has been made which assures clean, dry and spotless plated work. The cylinder of the sawdust barrel is steam jacketed and is made of steel boiler plate. The inside of the cylinder has four ribs to keep the work and sawdust tumbling.



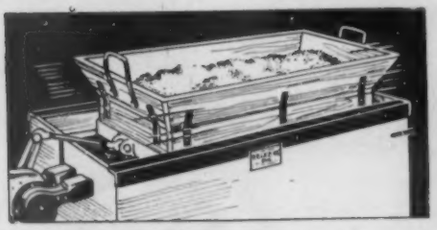
A tank magnet for quickly removing fallen steel articles from tank.

(The Belke Mfg. Co., Chicago, Ill.)

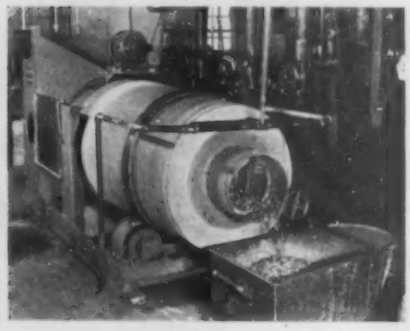
Sawdust Separator. Mechanical sieving of sawdust reduces staining and saves labor.

(The Belke Mfg. Co., Chicago, Ill.)

Hand-Griddle Method of Sawdust Separation.

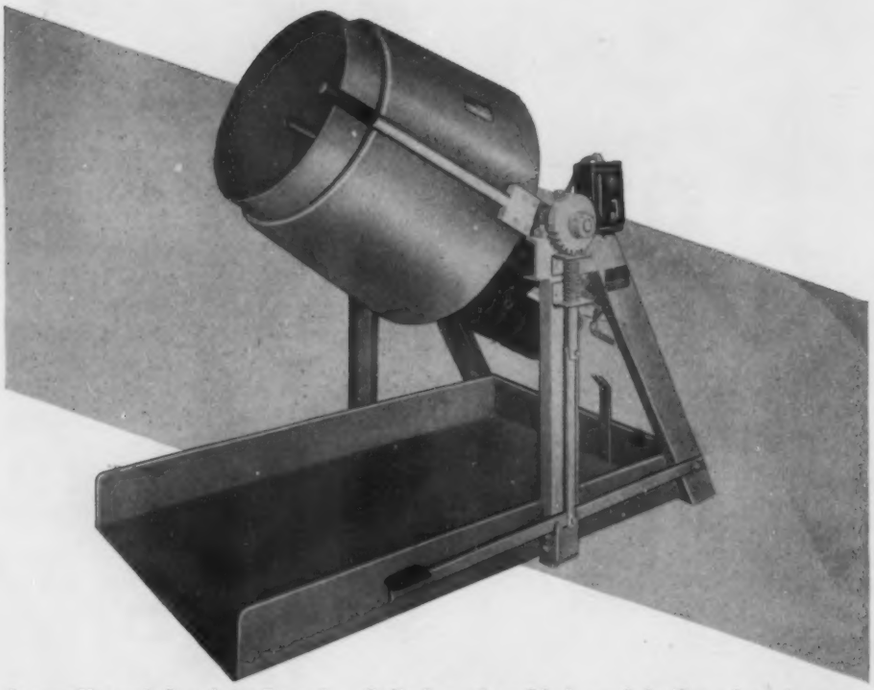


Mechanical Method of Separation. The cradle oscillates on ball bearing casters. Hopper lifts out.



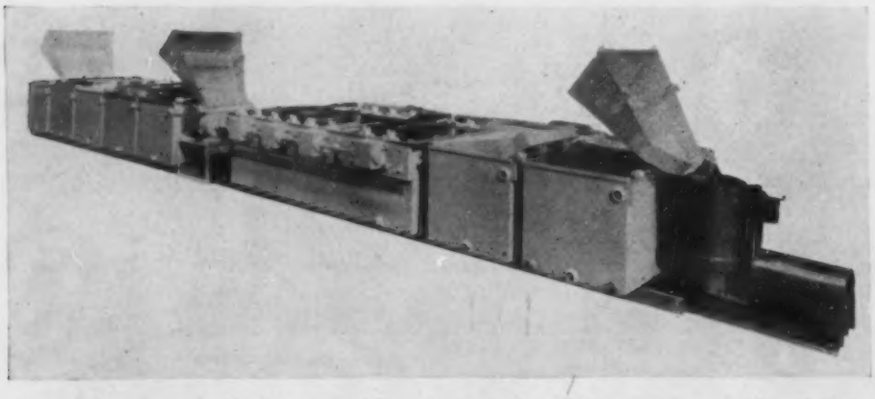
Automatic Ball Separating Burnishing Barrel.

(N. Ransohoff, Inc., Cincinnati, Ohio)



Steam-Heated Sawdust Barrel. Cylinder of welded steel boiler plate is steam jacketed and has four ribs to keep work and sawdust tumbling.

(The Belke Mfg. Co., Chicago, Ill.)



A complete barrel plating assembly; rinse tanks, plating tank and Mercil Type Centrifugal Dryer.

(Hanson-Van Winkle-Munning Co., Matawan, N. J.)

Interior view showing smooth steel and tumbling ribs.

New Unit Heater.

(Buffalo Forge Co., Buffalo, N. Y.)

The removal of steel work which has fallen to the bottom of plating tanks is facilitated by a newly available magnet[1]. The magnet is composed of a material which is capable of lifting sixty times its own weight and the standard magnet weighing less than a pound will lift 52 pounds quite easily.

1. Belke Manufacturing Company, Chicago, Ill.
2. Chas. F. L'Hommedieu & Sons Company, Chicago, Ill.

Fast Curing

Synthetic Finishes

By Ed. H. Bucy

Technical Director,
Zapon Division, Atlas Powder Co.,
Stamford, Conn.

The development of synthetic resins for finishing, particularly the urea-formaldehyde type, is discussed. The utilization of new synthetic resins in organic finishing materials for metals has resulted in vast improvements in this field.—Ed.

THE rate of change in the formulation and use of organic finishes has been accelerated during the past several years.

Before 1920, industrial finishes, in general, were of the oleoresinous type. That is, natural resins such as the copals (Manila, Congo, Kauri, East India and Pontianak), or such resins as the Damars, either Batavia or Singapore, were cooked with various vegetable oils. The principal vegetable oil, at that time, was linseed, although even then

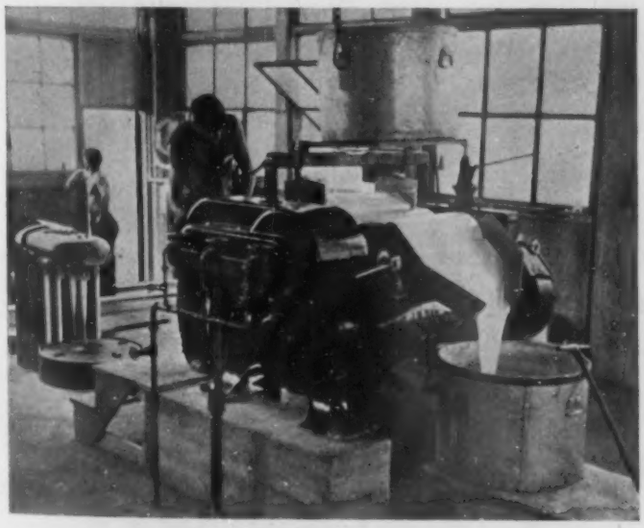


FIGURE I
Three roll mill

some small amount of work had been done with china wood oil.

The first synthetic resin had been used for some period of time, particularly, in the so-called "spar" varnishes. This resin, known as ester gum, made by the reaction of rosin (abietic acid) and a polyhydric alcohol (glycerol), is still in use.

While the phenolic condensation type of resin has been known since around 1900, its principal use had been as a plastic. Early in the 1920's, the use of the modified phenolic resins in coating formulations became general.

The phenolic resins are utilized by cooking with various amounts of vegetable oil. The amount of oil used was, and is generally referred to in terms of "oil length." For example, a so-called "short oil" formula of the type known as "4-hour finish" contains 100 pounds of resin cooked with 6 to 10 gallons of oil—a "longer" finish such as a

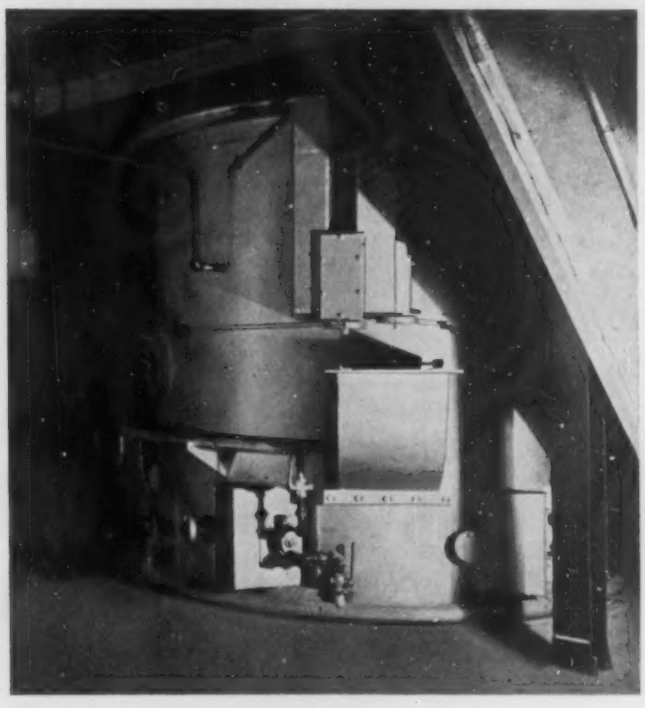


FIGURE II
Huge still for processing synthetic resins

furniture varnish, is made by cooking 100 pounds of resin with 15 to 25 gallons of oil—a very long "marine spar" might be 100 gallons long; that is, 100 pounds of resin cooked with 100 gallons of oil.

This same nomenclature will be used later in discussing the modern synthetic resins. Therefore, it is worth while keeping in mind.

The so-called "four hour" type of formulation was also modified, and used for force-drying or baking. These industrial finish formulations had excellent surface hardness, and gave good gloss and good initial adhesion to various metallic surfaces. However, due to progressive oxidation, the film became quite brittle upon aging, and finishes of this type also have very poor resistance to light.

War time development of synthetic acetone production had left a surplus of butyl alcohol as a by-product. The availability of this alcohol, and its ester, butyl acetate, together with the low viscosity nitrocotton development, resulted in lacquer products of lower cost and wider availability. The modern automotive production schedule needed such a finish, and shortly after the automobile manufacturers adopted the new development, many other industrial users also adopted it.

These fast drying lacquers were tried for many purposes for which they were not suited; for example, several large hotels and hospitals had their interior walls done in nitrocellulose lacquer. Time has shown that these uses were not warranted, but, due to the many advantages that

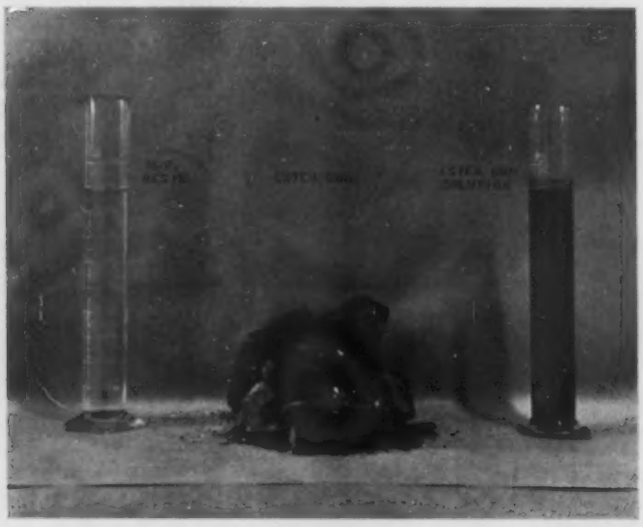


FIGURE III

Showing the difference in color between U.F. resin solution and an ester gum solution

the lacquer formulations had, they did find a great many industrial uses, which they filled satisfactorily for a number of years.

However, the instability of nitrocellulose to heat and sunlight, particularly, was responsible for the development of the next revolutionary finish.

The alkyd finish is purely synthetic in nature. It is made from a polyhydric alcohol, such as glycerol or sorbitol, and an organic acid such as phthalic or maleic acid. Modifiers, such as natural resin acids or fatty acids, from vegetable oils, are generally used to give additional plasticity and adhesion to the finish.

The nomenclature mentioned earlier, in dealing with oil varnishes, is normally used to describe the percentage of vegetable oil or fatty acid modifier that is used in making up these alkyd resins. For industrial use, these alkyds are usually made up in medium long oil length.

When a drying oil modifier, such as china wood oil, is used, an air-dry finish is obtained, although such finishes are not usually hard enough to handle or pack for at least 16 hours after application. The greater number of alkyd finishes are made with at least part of the modifier as non-drying oil or fatty acid. Soya bean oil or fatty acid is very generally used for the purpose. Such finishes must be baked after application.

The first pure white finish on refrigerators, for example, was made possible by this development. On ultra-violet light exposure, such a finish has more durability than the previous developments; adhesion and flexibility are excellent; baking times vary from 1 to 1½ hours in most cases, with the temperature between 275° and 325° Fahrenheit.

Due to the fact that an alkyd finish, when baked high enough to have the necessary salt spray and water resistance, discolors somewhat, it is necessary to use a two-coat finish, with the first coat completely baked out, and consequently somewhat off-color, and the second coat cured out only sufficiently hard to stand print test, or to allow packing. This procedure gives good durability and appearance, and these alkyd finishes, with their various modifications, are widely used. The automotive trade, for example, several years ago, adopted them for general use.

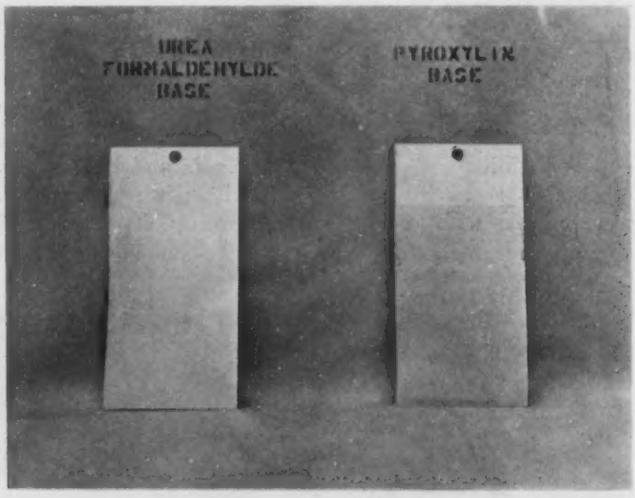


FIGURE IV

Showing the breakdown in a pyroxylin base film as compared to a U.F. base film, subjected for 8 and 22 hours in a test cabinet, under a carbon arc with water spray. The progressive discoloration of the pyroxylin base film can easily be noted in the picture

All types of industrial work, from clocks to baby carriages, are finished with them.

In the meantime, back in the 1920's, a group of chemists in Europe had been developing a resinous complex, made by combining urea and an aldehyde. While this resinous complex gave a material which was glass hard, and which had very many desirable qualities of resistance to chemical reagents, on aging, internal stresses were set up which eventually resulted in film breakdown by cracking.

The urea-formaldehyde resin base is highly heat and light resistant—it "cures" or bakes out very quickly at high temperatures. The alkyd finish, which was developed after the original invention of urea-formaldehyde material, proved to be the method by which the use of the urea-formaldehyde material became general.

The latest revolution in finishes is the combination of

a urea-formaldehyde resin complex with the proper fatty acid modified alkyd. The result is a type of new finishing material which has many advantages not predictable from either of the original resin characteristics.

In this manner, it is possible, by proper choice of ingredients and processes, to make a white finish, for example, which may be applied to refrigerators and washing machines, in one coat. This one coat may be baked out for ten or fifteen minutes at 325° to 350° F., whereas the old style alkyds, as mentioned previously, needed an hour to an hour and a half.

For finishes where complete color retention is not as necessary, urea-formaldehyde-alkyd finishes may be made using drying oil modifications. In this case, finishes may be made which may be baked out or "cured" in as short a time as one minute. Because of the exceptionally fast production speed possible, as well as the qualities of beauty and durability, this new type of finish is coming into wide use.

When the general methods of formulation of this new type of finish are understood, the versatility of the finish can be even better seen. The percentage of the urea-formaldehyde complex may be varied from as low as 10% to as high as 80% of the soluble solids; the higher the U.F. content, the better color retention, however, the lower the gloss, and poorer the adhesion.

The alkyd modifier used may, as mentioned above, be of the drying oil type, specifically linseed oil or china wood oil. These give films with somewhat inferior heat and light resistance, but give finishes which may be baked out at the most rapid schedules. The non-drying oil modified alkyd modifiers give, by far, the best color retention on light and heat exposure, and produce finishes which age the best. However, somewhat longer curing or baking temperatures must be used. A typical baking schedule for such a finish would be 10 minutes at 350° F. One coat finishes for washing machines, refrigerators and ironers, made with this last mentioned type of finish, should have a minimum dry film thickness, after application and curing, of approximately 1½ mils.

The modified urea-formaldehyde finish is not the last word in synthetic finishes. The next step, which has already been accomplished in the laboratory, is the production of finishes which require the removal of solvent, and then almost momentary exposure to a temperature such as 250° F., for surface flow, to produce a complete finish. Finishes of this type are not heat curing, but merely thermoplastic at the proper temperature. The modified vinyl resins, as well as the acrylic acid condensation types, fall within this classification.

There are still many other synthetic resinous bodies which are being developed and investigated at the present time, which may result in future revolutions in the finishing business.

Conductometric Methods for Analytical Determination of Metals

By Dr. J. Grant* F. I. C.

This article describes the manner in which conductometric methods can be applied to the analytical determination of silver, zinc, lead, potassium, calcium, barium and magnesium. It is claimed that very definite end-points are obtained by the use of the method and apparatus described.

THE metal industry provides several outlets of acknowledged usefulness for the application of electrical methods of various kinds. The electro-deposition of metals, for example, is used both as a manufacturing process and as an analytical method, and corrosion phenomena may now also be investigated electrically. One electrical method, however, namely the conductometric method, of a somewhat different nature, is less familiar, although it too has many valuable applications. The purpose of this article therefore, is to indicate some of those applications which, it is felt, deserve to be more widely known.

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Conductivity of Solutions

In conductometric methods, the electrical resistance (or its reciprocal, the electrical conductivity) of a solution is measured, and the result obtained is used as an indication of the nature and amount of the substances (metals in our case) present. That a solution may conduct electricity at all is due to the presence in it of charged atoms or groups of atoms (ions). When in this state, all metal ions carry a positive charge, while ions derived from acids carry negative charges. Consequently, when two electrodes connected, respectively, to the positive and negative terminals of a supply of electricity are placed in the solution, the positive metal ions travel to the negative electrode, and *vice versa*; in this way the ions enable a current to be passed through the solution, and it becomes a conductor.

It is apparent, therefore, that the extent of the conductivity of the solution depends in a large measure on the number and nature of the ions present, as well as on the

rate at which they travel through the solution. Similarly, if the nature and number of the metal ions present in the solution are continuously altering (*e.g.*, when the solution is being titrated), these alterations will be reflected in changes of conductivity.

Equipment

It so happens that the conductometric methods of most use in connection with the metal industries are concerned not so much with the absolute conductivity of the solution, as with these changes in conductivity, and this simplifies considerably the apparatus and technique involved. The first essential is a pair of electrodes, and these are usually made of platinum and are fixed rigidly in relation to one another so that the amount of liquid between them is constant; it is obvious that if the electrodes are moved so that they are nearer together or farther apart, this will produce a change in conductivity irrespective of changes in the composition of the solution. The electrodes are therefore either fixed to the side of the vessel containing the solution to be tested, or they are in the form of discs which are attached to a glass rod or tube, which is lowered into the solution when a measurement is to be taken. The distance apart of the electrodes depends on the nature of the solution; the higher its conductivity, the greater should be the column of liquid which separates them.

These electrodes are connected to a supply of electricity, and it should be pointed out that the latter must give alternating current. The reason for this is that with direct current there is a tendency for the solution to be electrolyzed, and the products of electrolysis liberated at the electrodes (usually hydrogen and oxygen gases) help to insulate the electrodes and so to lower its conductivity. With A.C. on the other hand, these objectionable products are removed as fast as they are formed, by the continual and rapid reversal of the current. A simple and convenient source of A.C. is a small induction coil. An objection to this is the noise it produces, but this may be eliminated by the use of an ordinary bell step-down transformer which enables three volts to be obtained from a 240 volts A.C. supply. Other convenient methods are also available.

Procedure

It remains only to describe the method of actually measuring the conductivity of the solution. This too, is very simple, because it is adapted from the familiar Wheatstone bridge or the "Post Office Box." In its simplest form therefore, the circuit is as follows: Each of the terminals of the A.C. supply is connected to one end of a thin uniform wire stretched tautly along a metre scale. Another connection to each end of the measuring wire joins these in series with the electrodes in the vessel containing the solution to be tested, and a standard resistance of known value. Finally, a sliding contact which can be moved along the measuring wire at will and enables contact to be made at any point on it, is connected through a null-point instrument to the wire connection joining one terminal of the standard resistance with one of the electrodes in the solution.

It is thus apparent that if the sliding-contact is moved along the wire until the null-point instrument shows that no current is passing through the system, then the ratio of the lengths of wire marked off in this way is equal to the ratio of the resistance of the test-solution to that of the standard resistance. In this way the resistance of the standard solution may be calculated by simple proportion, and from it, the conductivity, its reciprocal. In actual practice it is necessary however, only to read the position of the sliding contact on the metre scale.

The difficulty of finding a suitable null-point instrument to indicate the presence or absence of A.C. proved a stumbling-block which held up the practical applications of the method for many years after it had been firmly established as a tool for academic work; it is in fact, only comparatively recently that this difficulty has been overcome. In the early days of the method, a telephone receiver was used, and if when connected up no sound was heard, this indicated that no current was passing. Unfortunately complete silence could not be attained, and it was therefore necessary to decide when the sound was at its minimum. The objection to this method on the grounds both of convenience and accuracy is obvious.

Numerous methods of overcoming this difficulty have recently been suggested. Examples are rectifiers of various kinds, mechanical and otherwise, including the thermocouple, the crystal detector (familiar in the early days of wireless), and the thermionic valve more typical of radio in its up-to-date form. These methods have so far advanced that it is now possible to obtain a continuous record of the changes in conductivity of any solution of a metal.

Applications of the Method

Some of the more promising applications of the method to the metal industries will now be indicated. However, in order to illustrate how the method is used, the simplest example namely, the neutralization of an acid by an alkali, will first be described. Acids yield hydrogen ions when in a solution, and since such ions have a very high mobility, solutions of acids have a high conductivity. If, however, an alkali is added, the hydroxyl ions which are characteristic of all alkaline solutions link up with the hydrogen ions to form water. Both ions are thus removed from the sphere of action, at least so far as increasing the conductivity of the solution is concerned, and the conductivity falls progressively. This continues until there are no more hydrogen ions left, *i.e.*, the acid is all neutralized. Addition of one further drop of alkali therefore, provides hydroxyl ions which can find no hydrogen ion partners and as they also have a high mobility, the conductivity starts to rise again. It is evident therefore, that the point of minimum conductivity is the end-point of the reaction. This is obtained by plotting the conductivity measurements against the amount of alkali added; or when a recorder is fitted, there is of course no necessity even for this operation.

Silver

Similar reasoning may be applied to reactions involving metals. An interesting type of reaction is one in which an insoluble precipitate is formed, so that one or more metals are removed from solution and therefore, from the conducting system. An example is the determination

of silver by titrating a solution of this metal into a known volume of a standard solution of a chloride. Silver chloride is precipitated, and as this is insoluble, neither the silver nor the chloride ions can contribute anything to the conductivity of the system. The result is that the conductivity falls gradually until the last of the chloride ions has been precipitated. The next drop of the solution contributes to the solution, silver ions which can find nothing to precipitate, and they therefore remain in solution and raise the conductivity. Further drops of the silver solution cause a continuation of this rise, so that if the results are plotted they produce two inclined straight lines, meeting at an angle corresponding with the end-point.

The silver may be brought into solution by any of the usual methods, and a solution of silver nitrate is usually most convenient for the purpose. Incidentally, chlorides may also be determined in this way; the error is only 0.01 c.c. of a 0.005 N solution of silver or 0.7 mg. of Cl^- The method offers obvious advantages for use with colored solutions or where electrode poisons, which preclude the use of potentiometric methods, are present. Although reference has been made to the use of a curve to indicate the end-point, this is not laborious and indeed it may be avoided in some cases because any two points on each arm of the curve serve to give the slope of the two lines concerned. An alternative precipitant for silver solutions is potassium thiocyanate, in which case silver thiocyanate is produced.

Zinc

This type of application may obviously be used with other metals for which a convenient reaction exists. An example is zinc, which may be precipitated in the form of the insoluble zinc ferrocyanide. As with silver, therefore, the zinc is brought into solution (preferably in the form of chloride) and is titrated into a known volume of a solution of potassium ferrocyanide. A disadvantage of the method is that this reaction takes place rapidly and completely only when the solution is hot; as the conductivity of a solution is rather susceptible to changes in temperature it is a good plan to standardize the ferrocyanide solution under exactly the same experimental conditions by means of a solution of zinc chloride of known strength. A method for the titration of zinc with sodium hydroxide has also been proposed.

Lead

Lead forms the insoluble yellow lead chromate with a solution (*e.g.*) of potassium chromate, and it too may therefore be determined by this method. A solution of lead chloride should be used, because this has a relatively high conductivity, and the first drop in excess is therefore readily indicated. With this, as with other reactions involving the formation of precipitates, care should be taken that the electrodes in the conductivity cell are of such a shape and are so placed that the precipitate does not lodge on them, as this in itself will tend to lower the conductivity of the system. The use of vertical electrodes placed on one side of the cell, and well away from the bottom and the place where the solutions first meet one another overcomes this difficulty.

Potassium and Calcium

A useful device sometimes adopted to accelerate precipitation in cases where this tends to be slow, and so to hold up the course of the titration and affect its accuracy, is the addition of a solvent which mixes with the water and produces a mixture in which the precipitate is less soluble. Examples are alcohol and acetone, the former being particularly useful. A method which may be used for the determination of calcium or potassium provides a case in point. Thus, if calcium ferrocyanide is added to a solution of potassium (*e.g.*, as chloride), the insoluble potassium calcium ferrocyanide is precipitated, and calcium ions are formed in solution. In the presence of 36 to 50 per cent of alcohol this takes place rapidly and completely, the potassium ions in solution being replaced by calcium ions. This does not alter the conductivity to any great extent, so that this portion of the curve is an almost horizontal straight line. When all the potassium has been precipitated in this way, however, the excess of calcium and ferrocyanide ions produces a rapid rise in conductivity. Another device adopted in this case is to accelerate precipitation by "seeding" the solution with a little finely-powdered potassium calcium ferrocyanide, and here again too, it is preferable to standardize the procedure by first using solutions of calcium or potassium of known strength. The error is then reduced to $\pm$ 1 to 2 per cent.

An alternative method for potassium which gives the same type of curve, is the formation of the insoluble perchlorate on titration with sodium perchlorate. As, however, this is only complete at temperatures near 0° C. it is not very convenient to use. The ferrocyanide method for zinc described above, may of course also be adapted to the determination of potassium (or sodium) by choosing the appropriate soluble ferrocyanide as titrating agent.

Barium

The familiar reaction of barium chloride and a sulphate to produce the insoluble barium sulphate, has been used for the determination of sulphates and may be adapted to the determination of barium also. Here again the reaction is not complete and instantaneous, but the addition of 30 per cent of alcohol helps it. Here again, too, standardization of the method with solutions of known strength is desirable, because the precipitate itself will conduct a current to a slight extent.

Magnesium

A very sharp end-point is obtained if magnesium (in the form of sulphate) is titrated with barium hydroxide, because magnesium hydroxide and barium sulphate are then produced, and both are insoluble in the surrounding medium.

In conclusion, it should be pointed out that the applications of the method are not restricted to metals. It has in fact been used with great success for gasometry, for the determination of organic substances such as soaps and solvents, for soil analysis, and for the control of sugar-boiling and of the moisture and ash contents of products such as wood and milk, respectively. In connection with steam-raising and the control of water-supplies, a complete scheme of analysis has been worked out.

Depositing Uniform Thicknesses of Metal for Plating to Specifications

By Joseph Haas

Electrochemist

This is the concluding installment of the article which appeared in the October, 1938 issue. Methods for the practical control of electric lines of force and operating conditions for plating to specification are given.—Ed.

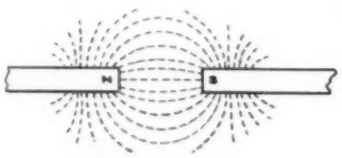
Practical Control of Electric Lines of Force

The distribution of the electric lines of force in a plating solution is dependent upon the shape of the tank, the shape and form of the electrodes, the distance between the anode and cathode, and the temperature of operation of the solution.

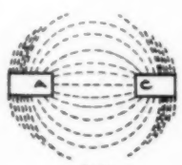
The writer has had no opportunity to conduct controlled experiments to prove this statement but has found it true from the results of practical experience. When engaged in the plating of surgical instruments, it was noticed that scissors, scalpels, etc., located throughout the center of the nickel plating solutions, operated at 1.5 volts, received considerably less deposit of nickel than those located lower and higher in the solution and at the ends. At first this was judged by the sheen of the deposited nickel and "cut throughs" by the buffers. This was confirmed by weight determinations, and ratios of the amounts of nickel deposited at the various sections of the tank were determined. Keeping in mind that heat decreases the conductivity of metals and increases the conductivity of electrolytes or solutions, heat was applied to the nickel solution (110 deg. F.) and the appearance of the sheen on the nickel plated surgical instruments became more uniform.

It may be thought that this "evening-up" in appearance and elimination of "cut throughs" was due solely to an increase in conductivity of the nickel solution, thus resulting in an increased amperage that deposited more metal at 1.5 volts. However, such was not the case because weight determinations made on the articles situated at various sections of the tank as before, showed a decided decrease in the difference ratios, thus showing that heating had also been effective in producing a more uniform distribution of the nickel deposit. Heating had brought the conductivity of the solution nearer to the conductivity of the metals, immersed in the solution so that the electric charges on the electrodes, no longer had a tendency to concentrate at the extremities and edges, but distributed themselves more evenly over the surface of the work, producing in a more uniformly distributed electric field, a more uniform attraction of metallic ions and consequently a more uniform deposition of the nickel deposit.

FIG. 2



2A
MAGNETIC FIELD BETWEEN SIMILAR POLES OF TWO MAGNETS



2B
ELECTRIC FIELD BETWEEN ANODE AND CATHODE IN A PLATING SOLUTION

That the distance between the anode and cathode has an effect on throwing power and affects the uniformity of deposition has been long known by platers. Increasing the distance between the anode and cathode was a wrinkle practiced by platers, when they had to throw or deposit metals into hollows and recesses. The explanation for this can be found in Fig. 2A. If the distance between the two magnets here shown is increased, the curved lines have a tendency to straighten. A logical assumption then would be that the lines in Fig. 2B would do the same thing, thus approaching a straight line electric field between the anode and cathode and producing a more uniformly distributed deposit. Lukens in his work with the exploratory electrodes showed that moving or changing the position of the electrodes in relation to each other altered the electric field.

When elliptical anodes, fishbone, and later ball anodes were introduced in the plating industry, claim was made for them that they would dissolve better and that there would be less waste than with flat anodes. At those times, operating tests made by the writer also showed more uniformly distributed deposits over the cathode area. These results are so well known that they need only to be mentioned although frequently platers lose sight of this factor and many still use flat anodes especially in copper and brass plating.

In the flatware industry the amount of silver deposited upon teaspoons, tablespoons, etc., is designated as a definite weight per gross. Therefore, one such article is expected upon analysis, to have 1/144th of the specified amount.

Determination of weight per article brought complaints of lack of uniformity and deposits which were under specification weight, even

though some articles were considerably overweight. The articles were plated in the usual horizontal tank and agitated in a horizontal plane. To eliminate the complaint, racks of flatware located in the center of the tank were used as a guide (or pilot) for weight and were weighed by the displacement in water method. While this satisfied the customers, it did not satisfy the cost department as the racks at the ends of the tank showed considerable overweight, and the amount of silver used was out of proportion to the quantity of articles plated.

Here again the divergent electric lines of force were playing havoc with the uniformity of the distribution of a deposit. It was decided that if the anodes were so placed that the ends or sides of the tank did not attract the electric lines of force a more favorable distribution of the electric field could be obtained.

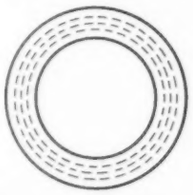


FIG 5

MAGNETIC FIELD OF A RING MAGNET OR ELECTRIC FIELD IN A SOLUTION CONTAINED IN A CIRCULAR TANK

A knowledge of the magnetic field of a ring magnet was applied (see Fig. 5) and a circular tank was the answer to this problem. Weight determinations in both the horizontal and circular tanks confirmed this. Differences in weight ratios were reduced in the circular tank. The only ratio that did not improve to the same extent was the ratio through the center of racks. This would have improved if the articles could have been given a vertical motion in addition to the circular motion.

Later it was also found that conveyor tanks similarly aided uniformity of distribution of deposits because the articles in moving through the tank, were subjected to *all* the various concentrations of electric lines of force.

Practical Operating Conditions for Plating to Specification

We are now ready to summarize the conditions under which a plater required to plate to a thickness specification should operate to obtain his minimum thickness on significant surfaces, and as nearly as possible, uniform deposits.

The Equipment

1. *Tanks*: circular or horizontal conveyor with anodes at ends.

2. *Anodes*:

(a) Determine for your shape and form of articles, the proper distance from cathode.

(b) Use elliptical, fishbone or ball. They should be bagged to prevent metal particles from floating through solution or the anodic section should be screened from the body of the solution by a cloth diaphragm.

(c) Depth of anodes and cathodes should be equal. In some cases it may be advisable to use several different lengths of anodes arranged in a pattern to modify the electric field in the solution.

3. *Racks*: The question of rack design and construction has been given too little attention by the plater. The following points should be kept in mind:

(a) The rack should be a good conductor and of sufficient capacity to carry the current without heating.

(b) It should be mechanically and electrically perfect. There should be no loose parts; it should make a firm and large area contact with the cathode rod.

(c) It should allow the articles to be arranged so that the current density (or electric lines of force) will be as uniformly distributed as possible; that shading of parts cannot occur, and by the use of wires, projecting parts are protected from excess deposits.

(d) It should be constructed so that articles can be hung in such a manner that pocketing of solution cannot occur where it is desired to obtain a heavy deposit, and that articles will drain completely and rapidly when removed from the solution.

(e) It should be covered with insulating material, not so much to save metal (except in the case of gold and silver) as to restrict the electric field in the solution to the articles being plated.

Method of Operation

1. *Cathode.* The cathodes or work should be in motion, either circular or on a horizontal conveyor with anodes at the ends of the tank. In this way the entire cathode is passing the different sections of the tank and under the influence of the various electric lines of force. If possible a simultaneous vertical motion to the cathode is desirable. Vertical or horizontal motion alone will not give the best conditions for a uniformly distributed deposit, but they are better than none.

2. *Solution.* To equalize density and remove sediment and loose metallic particles, continuous filtration is essential.

3. *Temperature.* The solution should be operated warm. The best temperature must be determined by the plater for the solution he is operating, that will give him the most uniformly distributed deposit. This factor must be determined in conjunction with the distance between anode and cathode and current density used.

The solution used should be made up of a salt which will give a high metal concentration but low metal ionization, or in other words, a complex salt. If such a salt is not available, a conducting salt should be added, which will aid the formation of a complex salt; or a salt with a common ion should be added to retard the ionization of the metal. In addition each solution should contain a "buffering" agent, to protect the solution from rapid changes or wide fluctuations in pH.

The factors to be considered in operation are the effect of current density, solution agitation or electrode motion and temperature. Since each manufacturer's problem is a separate engineering problem, no hard and fast rules can be laid down. The above factors have opposite and conflicting effects upon throwing power, and must almost always be determined by trial and error.

However, we may make some assumptions, in order to outline our procedure. Let us assume that the quantity of production has been determined so that we can estimate approximately, the size and number of plating tanks necessary. If the nature and shape of the articles permit, without question the circular rotating cathode or conveyor tanks are the best. They should be equipped

with variable speeds. Next we determine the area of the articles to be plated, the time required to plate them at an assumed C.D. at 100% cathode efficiency to give us a specified or desired thickness of plate. We correct this time for the actually determined cathode efficiency of our solution.

At this point, from our calculated plating time, we can quite definitely, for a certain production, decide on the length or size of our tanks and the quantity required.

Our next step will be to determine the temperature of operation, at a specific cathode and anode distance to give the best throwing power. The lowest possible temperature should be used. Next we study the effect of increased current density to reduce our plating time and yet give us the desired throwing power. We keep stepping up the current density, determining the distribution of the deposit in any of the usual ways practical to our case.

From here on, it becomes a see-saw problem, balancing the factors of cathode motion, temperature and current density, together with changes in the composition of the solution, until we arrive at the best conditions to give our specified thickness, uniformly distributed in the least possible time.

For a plant that has its equipment already on hand, let us say still tanks, the factors to be balanced are solution motion (cathode motion and continuous filtration) and the temperature to obtain the best current density for the most uniform metal distribution. More than likely changes in the composition of the solution will also have to be made.

However, it should be understood that a plant equipped with the old-fashioned still tanks, will have to control its thickness specifications from the middle section of the tank and will have many of its products over-deposited to meet a minimum thickness specification.

Hydraulic Tube Bending Machine

The photograph shows a new type of hydraulic bending machine, four of which have recently been installed by one of the largest tubular furniture manufacturers.

This machine will produce bends up to 190° and 12" radius, with or without a mandrel. Bends can be made at remarkable speed as only one control lever is required. The tubing is placed over the mandrel against a stop and when the control lever is actuated, the bronze clamping

Courtesy of The Howell Co.

die engages the tube, and the vertical spindle, on which the bending die is mounted, starts to rotate. When the bending operation is completed, the lever is reversed, which first opens the dies to remove the tube, and without further control the dies will return to their original position.

This machine incorporates two outstanding features:

1—Tube bends free from die scratches, and

2—Bends that require no further adjustment

There are four hydraulic cylinders to function the following movements:

1—Clamp the tube

2—Advance the mandrel

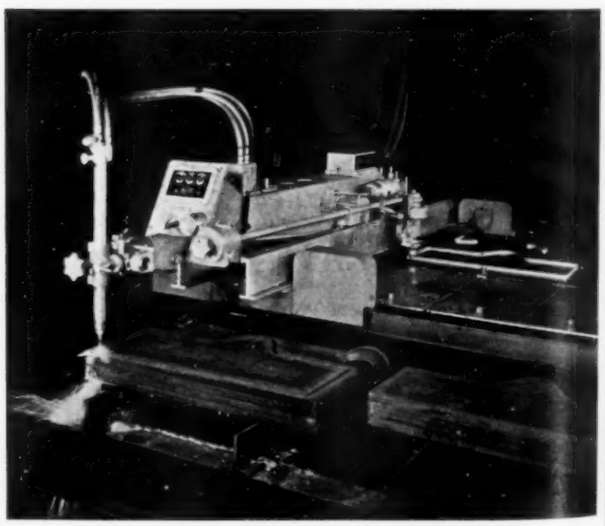
3—Move up the rollers that back up the follower strip

4—Rotate the tube forming die

By adjusting the micrometer setting of the stops for locating the limit of a bend, the machine can produce exact repetition of any desired angle of bend up to 190°.

Stack-Cutting with Oxy-Acetylene Machine

Quantity production of parts flame-cut from relatively thin steel plate by oxy-acetylene cutting machines is greatly facilitated by the use of a method that involves piling a



Courtesy of The Linde Air Products Co.

number of plates one on top of the other, clamping them tightly together, and making the cut as if the clamped plates were one piece of solid metal. This process, known as stack-cutting, has made practicable the cutting of thin sheets and has resulted in an increase in the production capacity of the oxy-acetylene cutting machine.

Development of Filters for Plating Solutions

By William E. Belke

President,
Belke Mfg. Co.

WILLIAM E. BELKE

The author presents an interesting account of his work on the development of filters for plating solutions. Pneumatic, Hat Type, and Multi Disc filters as well as filter presses are described.—Ed.

EARLY in 1921, William E. Belke conceived the idea of filtering plating solutions. At that time, it was universally accepted that precipitates in the bottom of plating tanks were a very unavoidable part of the plating solution. In fact, when the author displayed his Pneumatic Filter at the Annual Convention of The American Electroplaters' Society in 1922, it caused considerable discussion and argument, the general outlook at that time being in disfavor of filtering.

Belke pioneered the idea of filtering plating solutions while working as an engineer at the Sears-Roebuck Printing Plant in Chicago. This company had adopted air agitation introduced by Mr. Leuchter of New York. The air agitation had greatly increased the speed of plating electrotypes but at the same time it stirred up the sediment which caused roughness on the work where the particles settled.

The writer was called in by the general manager and was confronted with this problem. When the small particles settled upon the wax mould or lead mould, they left little pin holes in the electrotype after it was finished. The cheapest method of filtering was desired and with nothing really to fall back on, and with air available, the idea of the *Pneumatic Filter* was conceived.

This air filter was derived from the standard method of raising water in deep well work. The air was injected into the bottom of the piping and as the bubble arose, due to its buoyancy, it expanded until it filled the full diameter of the pipe and acted as a piston, forcing the liquid up ahead of it. This idea seemed to be a good way of handling the plating solution. Air was available, as it was then being used on the air agitation.

The filter, as it was originally made, consisted of a lead coil with graduated openings resting on the bottom of the tank, through which the solution was drawn. The idea

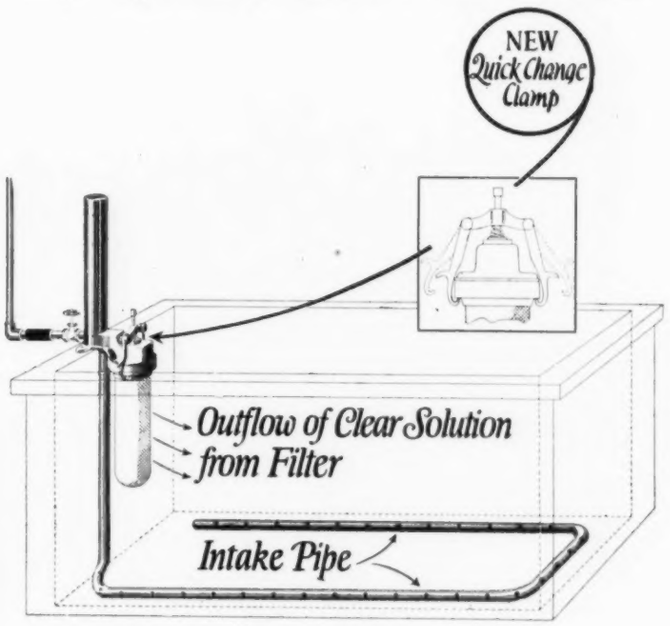


FIGURE I
Original pneumatic tank filter

of the graduated openings was that the suction was not very strong, although constant, and if the openings were large at the beginning, nearest to this vertical pipe, the solution would all come into these first two or three holes. Therefore, after careful testing, a pipe was finally designed so that the holes were graduated and regulated from the stand-pipe out to the extreme end of the pipe in such a manner that the solution would also flow equally from all parts of the coil.

This produced an even suction of the solution from all parts of the bottom of the tank, keeping the whole tank clean. The solution rose in the stand pipe into an overhead chamber where the air could separate from the

solution and find its way out through a small opening in the top of the reservoir. The solution now accumulating in the stand-pipe was allowed to flow by gravity plus the accumulated pressure of the air that was in the reservoir which was greater than atmospheric on account of the limited size of the opening at the top of it, back through the front into the filter bag, approximately 20" long by 5½" in diameter, made of felt filter cloth.

This filter was installed on an air agitated nickel tank and for the first week, the operator was busy almost every fifteen minutes emptying the accumulated sediment out of the bag, but after ten days, the solution was kept perfectly clean and it was only necessary to empty this sack approximately once a day.

Harry Huff, President of the Electrotypers' Society and owner of the Chicago Electrotype Foundry, then installed some of these filters at his plant, and obtained excellent results.

By this time, Henry Herr of the Acme Electrotype Company, and many other electrotypers had visualized the importance of filtration and soon the demand was so great that the writer left his employment with Sears-

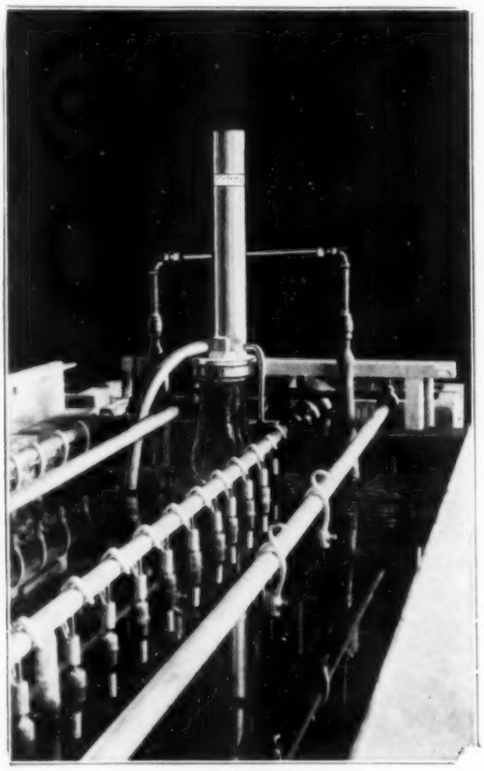


FIGURE II

Pneumatic filter which has been in use for 15 years

Roebuck Company and started to manufacture filters for the plating trade.

The demand for this filter was so heavy that within the first twelve months, approximately 3,000 filters were installed in the United States, Canada, and England.

In the meantime, other persons had become interested in the pneumatic filter and in the plating trade. Against general public opinion and the advice of experts of the day, Oscar Servis of Felt & Tarrant Co., decided to use one on his nickel tank. This pneumatic filter is still being used by Mr. Servis and has been in operation for over a decade from 1922 until now. No parts needed to be replaced as the structure is entirely of chemical lead and there is nothing to wear out or spoil. So, really to Oscar Servis belongs the credit of being the first person, to the writer's knowledge, of using a filter for regular commercial plating solutions.

Other platers quickly followed Mr. Servis' example, and for the next three or four years the general trend was to use pneumatic filters. In the meantime, semi-automatic conveyors and full automatics, etc., were being introduced to the plating trade. These tanks were considerably larger than the old fashioned small five and six foot tanks, then commonly used, and a more speedy filter was necessary.

Belke then put a new filter on the market with greater

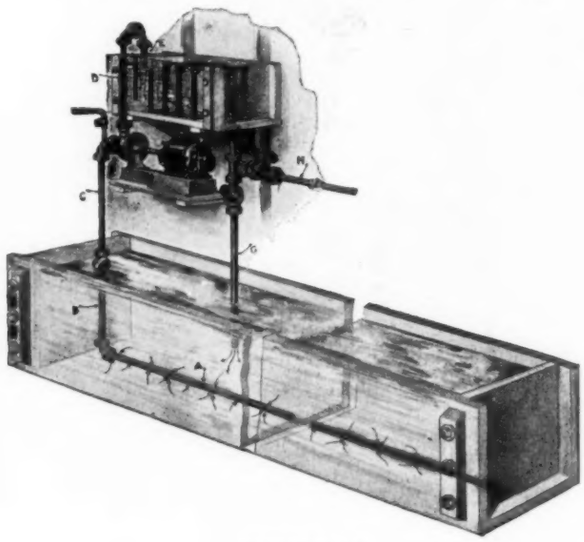


FIGURE III

Tank filter system

filtering capacity, but working on somewhat similar principles to the pneumatic unit, except a pump was substituted as a source of motive power which increased the flow of solution and gave much added capacity. This unit was called a *Tank Filter System*. It consisted of a motor-driven pump and the necessary piping, in addition to a filter tank. The filter tank was placed upon the wall or hung from the ceiling over the conveyor tank or large tank that was to be filtered.

The filter tank contained three separate screens which were arranged as slides and could be lifted out of their grooves and cleaned. The solution was pumped into the front end of the filter tank where it flowed first through a coarser mesh filter, then through a finer filter material, and, finally, through a very closely woven fabric which removed the small remaining amount of sediment that still had passed through the first two units. From there, the solution collected in a reservoir at the opposite end of the tank and flowed directly back into the original solution by gravity. This process was continuous, and very efficient, but the flow was limited, to a great extent, by the limited filtering area and the lack of pressure or head of liquid against the filter screen.

A large number of these filter units were sold to the trade and are still in active operation.

The author then working against the limits and problems of this filter next developed the *Hat Type Filter*, which consisted of an inverted filter hat on the lead pot stand and pumping the solution through the filter hat with a lead pump. This was met in the trade with a great deal of enthusiasm and there were hundreds of these filters sold.

In the hat type filter, a motor driven pump was used

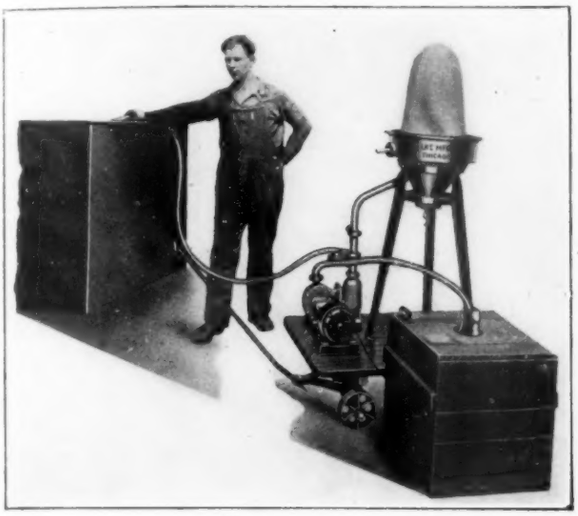


FIGURE IV

Hat type filter

and the whole filter unit was mounted on a truck. This was the advent of the portable filter, one where the filter could be moved from tank to tank and each particular tank cleaned, one at a time. The solution was drawn into

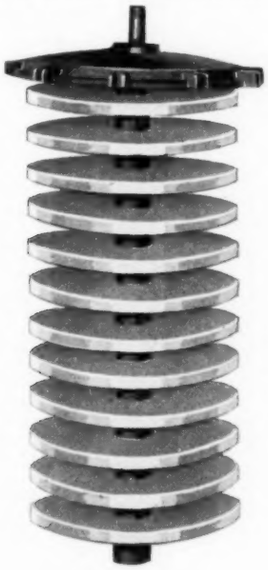


FIGURE V

Discs for present style multi-disc filter

the suction hose nozzle, forced by the pump up into the reservoir which had an inverted filter hat fastened on top of it. The largest size filter hats obtainable were used, the diameter at the base being approximately 20". The solution rose in the chamber top, out of which the solution flowed through the filter hat, until finally the entire hat stood directly on end with the solution running out clear and clean from all sides. The liquid then ran into a trough around the outside of the hat from where it flowed by gravity, back into the original solution.

While this *Hat Type Filter* was being sold quite freely and being used quite generally throughout the country, many firms started to use centrifuge and cream extractors, etc. There was quite a heavy demand for this type of sediment separator which seemed to sweep the country by storm and many of us today can still remember how general this method of dirt extracting became and how rapidly it was adopted.

Naturally, this great demand for the centrifugal machine was very injurious to the sale of the filters developed

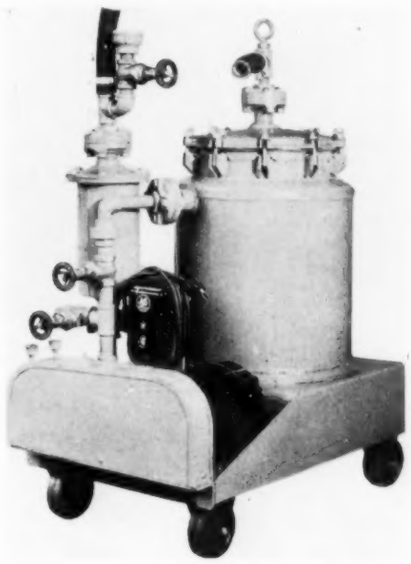


FIGURE VI

Modern Belke multi-disc filter

at that time. A filter was needed that could produce better results and faster results than the separators. Then the idea was formulated of putting the filter medium in an enclosed tank where great pressure and unlimited amount of volume could be handled. Thus was developed the *Multi-Disc Filter*. This is practically the present form of the filter of today, which is produced by The Belke Mfg. Company.

Two perforated sheets of metal, rubber plated, are spaced about ½" apart and these are covered with a filtering medium such as wool felt for the nickel solutions; for acid copper solutions, regular filter cloth; the regular cotton filtering material for the cyanide solutions; and asbestos filter cloth for chromium plating solutions. The discs have a hole in the center—there is a rubber separator between each set of discs and a stem which passes through the hole with a lock nut at the bottom so that any number of discs can be fastened, one below the other, giving any desired filtering area needed.

The filter pumps are made of whatever material is necessary for the particular solution being handled: for bright nickel, Worthite, Dur-Iron, and rubber are used; for cyanide solutions, all-iron pumps are necessary.

The filters have a long suction hose which is put into the

tank at any desired spot, with the suction nozzles on the bottom of the sides.

The solution is drawn through the suction hose into the pump and then forced into the filter chamber. The chamber is rubber lined in the case of bright nickel, lead lined in the case of chromium, or, all steel for cyanide solutions. The solution when it enters the chamber is under the full pressure of the pump and in order to find its way out must force its way through the filter covering on the top of the discs, down through the disc and out the center spine. Here it flows out through the top of the filter and back into the tank, or into any other tank that the operator may desire.

The filters are now made in any size and capacity desired by the trade, with the *Verti-Disc* and *Multi-Disc* filter. The pumps can be made in any size, the tanks and the capacity for filtration can be increased to any extent desired.

A great deal of improvement has been made in filtration by using filter aids, and activated carbon. The properties and utilization of these materials have been described in a previous issue of METAL INDUSTRY.[1]

Another type of filter is the *Verti-Disc* filter, in which the discs are arranged in much the same manner as in the *Multi-Disc* type, only the discs are vertical, the contention being that the precipitate has more of a chance to settle at the bottom of the tank, rather than upon the discs themselves, giving a little longer filtering time between cleanings.

In addition to the development of the pressure chamber type of filter, Belke introduced at the Cleveland Convention a filter press. This filter press is a standard type of mechanism and is put up in a very compact unit. It is mounted on a truck and can be moved around with a large bed plate underneath the chamber to take the precipitate or any leakage that might occur. Being of the standard type, with corrugated plates alternated by the plain barriers, no further description is necessary. This filter can be made with all lead plates, rubber covered plates, or all steel, depending on the service and condition under which it is to be used.

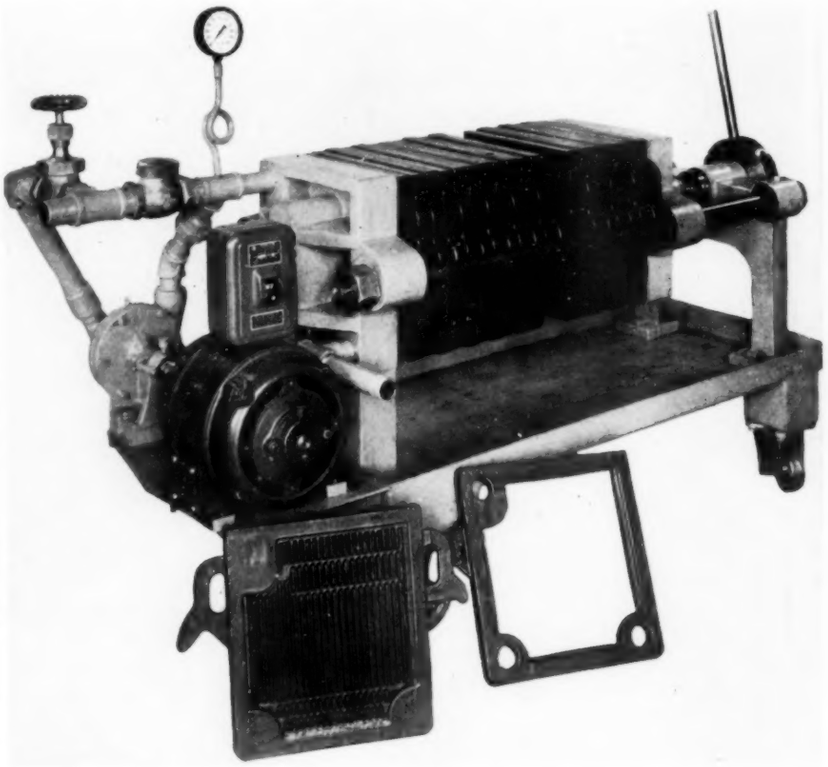


FIGURE VIII

The Belke filter press

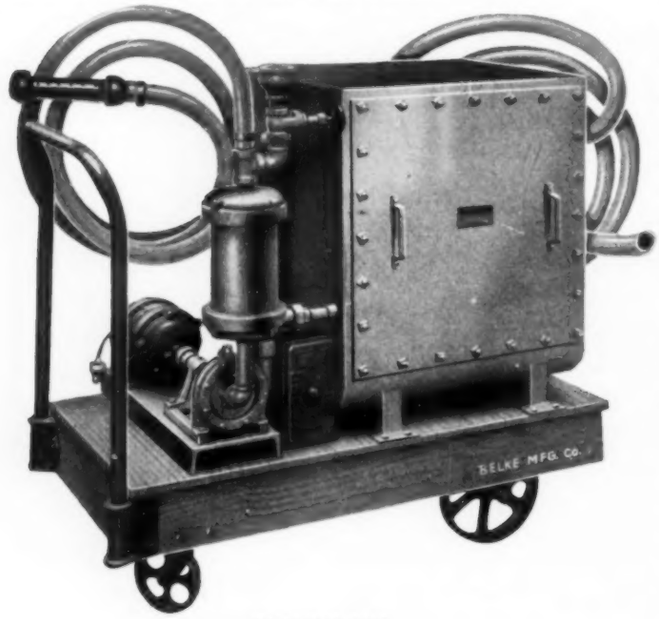


FIGURE VII

The Belke verti-disc filter

In conclusion, while there has been great improvement in the rapidity and methods of filtering, it is significant, however, that the first type of pneumatic filter which was designed eighteen years ago, is still in demand and functioning satisfactorily.

This type of filter has been adopted in various forms by all of the countries in Europe and is now one of the most used methods of filtering overseas. The *Pneumatic Filter* has given consistent trouble-free operation, keeps the suspended solution clear at all times and needs no electric current, no motor—and only using a very small amount of air, making a negligible cost of operation.

[1]Metal Industry, Vol. 36, No. 11, 1936.

Definitions of Terms Describing Abrasive Operations

By H. J. Wills

The Carborundum Co.,
Niagara Falls, N. Y.

This article is presented with the hope that it will lead to a standardization of terms describing abrasive operations.—Ed.

GRINDING is the process of shaping or finishing metallic or other hard surfaces by the use of a bonded abrasive wheel or disc mounted on suitable machines and operated at relatively high speeds. It may have for its objective the removal of stock in any amount to acquire dimension, surface qualities, or finish, or all three.

a. *Precision grinding* is that which is performed "to exact limitations" and with "strict conformity to rule or standard" on modern types of roll, cylindrical, centerless, surface internal or universal grinding machines.

b. *Semi-precision grinding* embraces that work where the limits of accuracy and finish are not as close as in precision grinding.

c. *Hand grinding* is a term applied to operations where the work to be ground, or the mechanism upon which the work is mounted, is held in the hands of the operator, or where the machine itself is moved by hand across the work being ground, such as in the case of portable or swing frame machines.

Honing is the process of making relatively small corrections in dimensions, shape or quality of surface, by means of bonded abrasive wheels, sticks or blocks, rotated or reciprocated (or both) at relatively low speeds. Honing is usually supplementary to grinding or other machining operations.

Lapping is the process of making extremely minute corrections in dimensions, shape or quality of surface by means of bonded abrasive wheels, bricks or sticks, or by means of loose grains used in connection with laps. The speeds employed for the rotating or reciprocating lapping media are usually relatively slow, but where bonded abrasive

FIGURE II

Roll grinding where high finish and extreme accuracy are required

Courtesy of the Carborundum Co., Niagara Falls, N. Y.

FIGURE I

Precision grinding in the tool room

Courtesy of the Carborundum Co., Niagara Falls, N. Y.

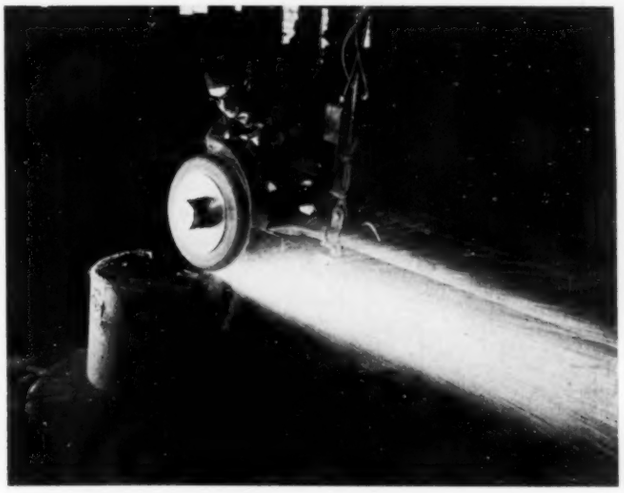


FIGURE III

Hand grinding of a large casting

Courtesy of Norton Co., Worcester, Mass.

FIGURE IV

Vertical surface grinding, abrasive segments in chuck

Courtesy of Abrasive Co., Bridesburg, Pa.

FIGURE V

Hand polishing

Courtesy of Norton Co., Worcester, Mass.

wheels are employed for producing extremely fine surface finishes, the speeds may be the same as are usually employed for grinding.

Rubbing is abrading by hand using bonded bricks or sticks.

Polishing is the process of removing an indefinite amount of material from any part or object by means of various types of yielding or cushion wheels and flexible belts to which abrasive grains are secured by glue or other cementing materials and driven at relatively high speeds. The wheels used for polishing are commonly known as "set-up" wheels. Polishing may have for its objective the reduction or smoothing of the surface to a common level for finish only where accuracy of dimension is not important. It

FIGURE VI

Lapping

Courtesy of Norton Co., Worcester, Mass.

may also be employed for removing relatively large amounts of material from parts of irregular contour.

Polishing can be sub-divided into the following:

A. *Roughing* is polishing on a dry wheel with coarse abrasives up to No. 60 grit.

B. *Dry Finishing* is similar to Roughing but the abrasives are finer, running from No. 70 to No. 120 grit.

C. *Oiling* is done with abrasives No. 120 and finer. The abrasive on the wheel is greased with tallow or similar material.

Buffing is a "smoothing" operation which is accomplished more by plastic flow than by abrading. The abrasives employed are finer and frequently softer than those used in polishing, and instead of being firmly cemented to the wheel

FIGURE VII

Sand bobbing copper percolator bodies

are merely held by "grease-cake" or other similar substances. Buffing wheels or "buffs" are usually operated at relatively high speeds. The usual object of buffing is to produce a high luster or "color" without any particular regard to accuracy of dimension or plane.

Buffing may be sub-divided into the following:

Cut-down buffing which denotes a rapid smoothing action resulting from buffing, with fast cutting compounds (usually containing tripoli or silica as abrasives) with higher pressures and peripheral speeds and harder buffs than in "color buffing". Abrading and plastic flow both occur.

Color buffing or *coloring* is a secondary process of buffing which imparts a very high luster or surface finish to buffed work. Very soft abrasives such as crocus (iron oxide) or lime (CaO) are used.

Sandblasting is the process of removing an indefinite amount of material from any part or object by means of loose abrasive grains blasted against the surface by power means. It may have as its objective the imparting of a finish, or disguising of surface imperfections, or creating letters or designs on surfaces.

Tumbling is comparable to polishing in that it prepares metal surfaces for finishing by placing articles in a revolving barrel with a charge of abrasive.

Sanding is a process of abrasion in which abrasive coated fabrics or paper are used to abrade, either by hand or power operated. No attempt is made to hold to high accuracy of dimension.

Sand bobbing is a process in which the polishing action is produced by the furrowing of relatively coarse abrasives applied loosely between the work and a revolving bob.

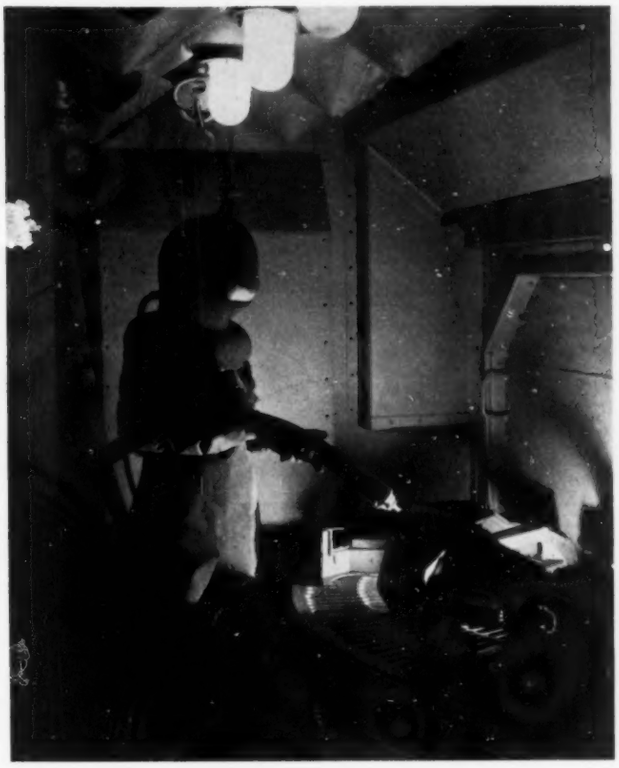


FIGURE VIII

Sand blasting

Courtesy of Norton Co., Worcester, Mass.

Semi-rigid, tough bobs or wheels of materials such as walrus hide are used shaped to the work being sand bobbed. The abrasive is usually pumice which is wet with mineral oil, lard oil or a mixture of these two oils. The abrasive may be applied by hand as illustrated in the photograph or mechanical methods may be used.

Sand bobbing is used chiefly on soft metals such as lead, tin or copper and their alloys to remove pits, scratches and other surface imperfections without the formation of dragging streaks. Polishing of soft metals is often not practical because of glazing of the polishing wheels.

FIGURE IX

Hand buffing

PLATING AND FINISHING
FABRICATION — ASSEMBLING
METALLURGICAL — ROLLING
CASTING AND JOINING

SHOP PROBLEMS

Technical Advisors For January Issue

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When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Full information is necessary in order to render proper service.

Silver Plate Terminology

Q. I would like information regarding the terms triple and quadruple plate on silverware. Is there also a term of single or double plate for silverware?

A. In this group there are only two definite terms recognized in the silver industry—Quadruple and Triple Plate.

"Triple" plate has an actual deposit of 6 ounces of pure silver to the gross on tea spoons and other items are silver plated in proportion to the size of the tea spoon and the particular usage of the article itself.

"Half Standard Plate" is sometimes called "Single" plate and has a deposit of 1 oz. per gross on tea spoons. Double plate has double the deposit of the half standard or 2 oz. to the gross and is called "Standard Plate." "Quadruple" Plate is four times heavier than standard, which would be 8 oz. per gross on tea spoons.

Arthur Schipke.

Mercury Plating

Q. We would like to know whether there is any method of plating mercury, and several years ago I read that mercurous perchlorate can be used for a plating solution. Will you give me details regarding this process.

A. Mercury can be deposited from many of its salts in aqueous solution, and is released at the cathode and falls to the bottom of the vessel in globules.

The nearest approach to mercury plating that is used today is in the use of a mercury dip to prepare articles for silver plating. Mercury is also a constituent in a very small amount in some types of zinc plating solutions but the mercury is deposited together with the zinc and not in the form of elemental mercury.

Mercury pastes are seen on the market which are used to coat objects of brass and copper with a film of mercury but this process would not be called electroplating, as the mercury attaches itself to the base metal by chemical displacement.

Mercurous perchlorate is not an article of commerce and is not stocked by any chemical houses. If this compound is desired it could probably be made by treating mercury with perchloric acid We cannot recommend that this be tried by anyone but a trained chemist working with proper equipment as care should be taken to control the reaction. While perchlorates are fairly stable, chlorates are not, and the formation of dangerously unstable compounds must be considered.

G. B. Hogaboom Jr.

Drag Marks on Nickel Plated Brass

Q. We are sending you a sample of nickel plated brass, the surface of which appears to be pitted and would like to know if this pitting is in the article itself or in the nickel deposit. Our nickel plating solution seems to be satisfactory and we are having no difficulty except with this one article.

A. Examination of the sample which you sent indicates that your difficulty is not due to nickel plating but is due to drag marks in the buffed brass. Conditions such as this have been observed in numerous cases and have been traced to either faulty buffing or to segregations in the castings themselves. Drag marks are formed during buffing, which may be due to holes in the casting, segregations of impurity or of lead. This difficulty can be corrected by changing the material or by sand bobbing the brass previous to buffing. The sand bobbing will enable the removal of pits and scratches without extensive plastic flow or dragging, such as you are now experiencing. W. R. Meyer.

Pewter Finish on Brass

Q. Will you please tell me how to obtain a pewter finish on brass castings without the use of electric current?

A. I do not believe it is possible to obtain a pewter finish on brass castings without using current as it is necessary to electroplate in order to obtain the proper color. Pewter finish can be imitated by slightly scouring the brass and then nickel plating, and for an old pewter appearance, the white nickel is black nickel plated and relieved. A better match for color, however, is obtained by plating in a tin solution or a solution containing a combination of lead and tin. Tin deposits can be darkened by brushing with a solution of:

Copper acetate .... 1 oz. per gal.
Ammonium chloride. ½ oz. per gal.
Water ..... 1 gal.

Wipe dry and lacquer.

Antimony is also used as a deposit to imitate a pewter finish and for methods of plating antimony, see METAL INDUSTRY, November 1938, page 528. Joseph Sexton.

Boric Acid in Nickel Plating Solutions

Q. Does the addition of boric acid introduce impurities into nickel plating solutions, and can boric acid be used to lower the pH of nickel plating solutions?

A. The impurities introduced by a good grade of boric acid will be practically negligible as commercial boric acid is usually over 99% pure and contains only minute traces of heavy metals. Boric acid is of little value in lowering the pH of nickel solutions, inasmuch as it is a very weak acid. The lowering of pH can best be done by the addition of sulphuric acid.

G. B. Hogaboom Jr.

Bright Dipping Zinc

Q. We are sending you a sample of rolled zinc under separate cover which contains 1% copper. The usual nitric acid—sulphuric acid bright dips do not brighten zinc but merely cause it to darken. Is there anything that can be used for producing a bright etched surface on this zinc?

A. The usual nitric acid-sulphuric acid dips are of no value for bright dipping zinc or its alloys. One of the best bright dipping solutions for dipping zinc and its alloys is composed as follows:

Chromic acid .. 30 to 40 ozs. per gal.
Sulphuric acid .. 2 ozs. per gal.

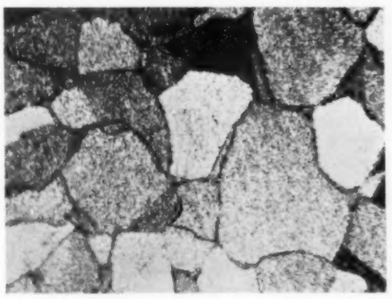
The parts are immersed in this dip for about 10 seconds and are then rinsed, preferably with running water. In case yellow stains form on the zinc which are difficult to rinse, they may be removed by dipping into a solution of ½% sulphuric acid by volume, followed by cold and hot water rinses.

W. R. Meyer.

Failure of Lead Cable Sheath

Q. We are sending you a sample of lead cable sheath which has been returned from the field. You will notice that the lead is very brittle and contains numerous cracks. Will you please examine this lead sheath and tell us what the difficulty is?

A. Microscopic examination of the lead sheath shown in the illustration indicates that the structure of the



Microstructure of lead sheath
100*x*

sheath is satisfactory. Spectrographic analysis of the lead indicates it to be of high purity and that it contains no detrimental impurities. The failure of this cable doubtlessly is due to fatigue as lead has low fatigue resistance and if the cable were free to sway with the wind, a sufficient number of cycles of stress could have easily been applied to cause fatigue failure.

W. R. Meyer.

Gun Metal Finish on Brass

Q. How can a gun metal finish on polished yellow brass be obtained?

A. Gun metal finishes on brass can be obtained in various shades by the use of different oxidizing agents. A muriatic acid and arsenic oxidizing solution gives a good color, but the best match may be obtained by the following procedure:

The brass is polished, buffed, washed, lightly scoured using water and pumice, nickel plated, black nickel plated, lightly scoured, again black nickel plated, lightly scoured, rinsed, dried and lacquered. In scouring the black nickel deposit, use a soft steel section wheel and little pumice. A formula for black nickel plating is:

Powdered arsenic ..... 2 ozs.
Ammonium carbonate ..... 2 ozs.
Double nickel salts ..... 12 ozs.
Aqua ammonia 26% ..... 32 ozs.
Water ..... 1 gal.
Add cyanide to clear.

Joseph Sexton.

Current in Barrel Plating

Q. We have experienced a puzzling occurrence during barrel plating in regards to the thickness obtained with various power inputs. When barrel plating at 6 volts, the cylinder drew 75 amperes and at 12 volts we were able to pass 125 amperes through the cylinder. However, when the plate was analyzed for thickness, the deposits obtained at 12 volts were less than twice the thickness of the deposits obtained at 6 volts using the same plating time and quantity of work. Inasmuch as 450 watt-hours were used with the 6 volt plating and 1500 watt-hours with the 12 volt plating, why shouldn't the deposits obtained at 12 volts be three times heavier than those obtained at 6 volts?

A. Your question is indicative of a rather general misunderstanding regarding the total wattage used in a plating circuit. For electroplating, the thicknesses of deposits should be calculated from the number of ampere-hours used rather than from the number of watts consumed because the total wattage includes the power wasted in electrical resistance throughout the entire circuit, anode and cathode polarizations as well as that used in producing the electrodeposit.

Obviously, when 12 volts were used your loss in current was considerably higher due to higher resistances of the conductors due to heating and also due to increased anode polarization.

It is evident, therefore, that the over-all efficiency of barrel plating is less when high voltage (12 volts) is used than with low voltage (6 volts) although the savings in labor by the increased rate of deposition may offset this lower efficiency.

W. R. Meyer.

METALLURGICAL DIGEST

SELECTED ABSTRACTS ON CASTING—ROLLING—PHYSICAL METALLURGY

Pressure Die Casting. Hans Lawetzky. Journal of Production Engineers (British), Feb. 1938; Metal Industry (London), April 1, 1938, page 359.

Where large quantities of metal parts cast to extreme accuracy are required, the pressure die-casting method is the most economical so far developed. It may be applied to zinc, aluminum and copper-base alloys. It has been experimentally successful in the casting of grey iron. Its principal limitation is the economical life of the die used, which at present limits the process to alloys having melting points below 1000° to 1050°C. Below such a temperature, any metal or alloy can be pressure cast which can be cast or forged.

Pressure casting has been developed from earlier chill casting methods. In the original gravity process, there occurred premature chilling of the metal which resulted in incomplete filling of the die and failure to attain sharp edges and thin wall sizes. For low melting-point metals, this was overcome by the use of a pressure chamber submerged in a pot of molten metal from which metal was delivered into the die by means of a piston or by air pressure. Although still used for lead, tin and some zinc alloys, this method is strictly limited as to the temperatures and pressures which can be employed. It cannot be used at all with the higher melting point alloys.

In more modern machines, the metal is heated in a separate furnace and ladled into a pressure chamber, from which a piston forces the metal into the die. The chamber and piston remain comparatively cool. A thin layer of chilled metal acts as a packing for the piston. Almost any injection pressure may be employed.

In pressure-casting machines, hydraulic pressure is used to activate the piston and also to lock the die and withdraw the cores. Usually the pump delivers pressure to an air-loaded accumulator, thus combining the quick action of air pressure with the rigidity of the hydraulic stroke. The injection pressure is regulated by valves, varying from one-fifth full pressure up to the maximum, depending upon the alloy being cast and the size and design of the casting. The speed of injection is controlled by means of a throttle.

Zinc alloys of the Zamak or Mazak type, based on 99.99% zinc, cast at a pressure of 5,000 lbs. per square inch and a temperature of 430°C. or above, yield a tensile strength up to 47,500 lbs. per square inch, and an elongation up to 12%. Under these conditions, it is possible to obtain the exceedingly dense skin required for electroplating if the latter is to have a satisfactory service life. For some alloys, lower temperatures must be employed and by the pressure method the metal may be in a plastic rather than liquid condition at the time of injection.

For aluminum base metals, pressures from 2,800 to 4,900 lbs. per square inch are most favorable. For some of these alloys the temperature must not exceed 580°C.; others which are to be heat treated are cast at 700° to 780°C. Pressure die casting has overcome the difficulty formerly experienced with the heat treatment of aluminum die castings due to air inclusions which formed blisters when heated. The combination of high temperature and high pressure eliminates such inclusions.

Magnesium alloys, such as Dow Metal or Electron, are difficult to cast because of their inflammability. They are heated in a special furnace under a neutral atmosphere and measured portions of metal are mechanically delivered to the casting machine. Castings made at a temperature of 600° to 630°C. and a pressure of 5,600 lbs. per square inch have a tensile strength of 14 tons per square inch.

In the case of copper alloys, because of their high melting point, the strain on the die steel would be excessive if the metal were cast in the liquid state. Also the temperature must be kept below the evaporation temperature of zinc in order to avoid gas inclusions. These alloys are therefore cast in a plastic condition at temperatures of 850° to 900°C. and pressures of 6,000 to 8,500 lbs. or even higher. Tensile strengths attained are 22 to 47 tons per square inch; elongation 6 to 14%.

Copper-base alloys which can be pressure cast include special bronzes or brasses with nickel, manganese and silicon, also nickel silver with nickel contents up to 9%. A higher proportion of nickel is not recommended since high casting temperatures would shorten the die life. In the case of gun metal also, while favorable experimental results have been obtained, the die life is not satisfactory.

Die design depends upon the kind of machine used and the number of castings to be made. For zinc alloys, low-carbon steel may be used for small quantity orders, and nickel-chromium steel for quantities above 50,000. Aluminum castings require chrome-vanadium or high chromium steels. High chromium is also employed for copper-base castings in small quantities; cobalt may be added if larger quantities are desired. In the case of aluminum, a die hardness of 46 to 52 Rockwell C is desirable to prevent sticking of metal to the die. All dies are water cooled but copper piping or other special means should be employed to prevent too intense a temperature difference between cooled portions and the die cavities.

The gating and venting are varied according to the shape of the casting and the kind of alloy used. The section of the gate at its smallest part is very important. The allowable depth is limited while the width only is varied according to the weight of the casting. For zinc, the depth should be between 0.003" and 0.016"; for aluminum and other high-metal alloys 0.06" to 0.15"; for copper-base alloys 0.06" to 0.12".

For very intricate castings, venting may be necessary and is accomplished by grinding shallow channels in the die at the parting line. Evacuation of air from the die cavity has been tried but has not been very successful; it is now used only for lead and tin alloys and for a certain special method for casting aluminum bronze.

Cores may be stationary or may be withdrawn hydraulically, singly or all together as desired. Attempts to use collapsible cores have not been successful.

Castings can be made weighing a few ounces up to 50 lbs. or more. As a rule quantities above 5,000 pieces may be economically die cast.

The lower the casting temperature, the higher the dimensional precision. Tolerances range from 0.001", plus or minus 0.15%, for zinc castings; 0.002" plus or minus 0.2% for aluminum castings, to 0.004" plus or minus 0.25% for copper castings.

A Study of the Mechanical Properties of Tin-Rich Antimony-Tin Alloys. By D. Hanson, W. T. Pell-Walpole. Institute of Metals, Paper No. 810, 1938.

Tensile and Brinell tests have been carried out on alloys containing 2-18% antimony in the form of machined chill-cast specimens, rolled strip and extruded wire. The results are given graphically. In any condition, little improvement is obtained by using more than 9% antimony.

The effect of progressive amounts of cold-work on the Brinell hardness of three alloys has been studied. Alloys containing 4 to 7% antimony can be permanently hardened by 10-30% reduction, but an alloy containing 14% antimony cannot be permanently hardened even by small amounts of reduction, and severe cold-work produces pronounced softening. Annealing restores the hardness to the chill-cast value in each case. It is suggested that grain-size may be an important factor in work softening and in subsequent recovery by annealing.

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—FINISHING—RUST PROOFING—LACQUERING

Electrolytic Coating of Aluminum (Die Metallwaren-Industrie und Galvano-Technik, Volume 36, No. 23, page 505).

The rapid formation of oxide coatings on aluminum hinders the obtaining of adherent electrodeposits upon it. Methods for plating upon aluminum are as follows:

1. The aluminum is etched in a warm caustic soda solution, consisting of 100 grams per litre of sodium hydroxide with 20 grams per litre of sodium chloride. The salt is claimed to reduce the attack of the alkali on the surface of the aluminum. The solution is heated to 125°F., and the work immersed until the first appearance of a lively gas evolution, usually 10 to 20 seconds. The objects are then rinsed and if the alloy contains copper, it is dipped into 1 to 1 nitric acid for a few seconds to dissolve the copper without attacking the aluminum.

2. Two types of bonding coatings are used, one being a solution of iron chloride and hydrochloric acid and the other a solution of sodium zincate, made as follows: 2½ lb. of caustic soda are dissolved in 1 gallon of water, and in a second vessel is dissolved a pound of zinc sulphate in a gallon of water. The zinc sulphate solution is then poured into the caustic soda solution with continual stirring. The etch is used at 105° F. The aluminum work is immersed into the zincate solution and agitated to secure a uniform deposit which is usually obtained within 30 seconds. After the zincate dip, the work is rinsed and can then be plated in a nickel bath containing citric acid.

For the coloring of aluminum, copper deposits can be produced upon aluminum from an acid bath composed as follows: copper sulphate 13.4 ozs. per gallon; nitric acid 11 ozs. per gallon. This bath gives good adherent deposits but has poor throwing power.

Electrodeposition of Tin from Alkaline Solutions. By S. Baier and R. M. Angles. Transactions of the Electrodepositors' Technical Society, 1938, pages 1-30.

Published data relating to alkaline tin plating baths have been surveyed and extended by further experimental work so as to provide a critical review of the behavior of these solutions.

The production of coherent tin deposits from stannite solutions is only obtained in the presence of suitable addition agents (and is limited to a definite range of stannous tin concentration). Practical use of these solutions is limited owing to the readiness with which atmospheric oxidation of stannite takes place. Alkaline stannate solutions, however, can be used over a very wide range of concentrations and plating conditions, but in contradistinction to stannite solutions, the cathode efficiency is greatly influenced by the plating conditions. Optimum concentrations for maximum cathode efficiency at various temperatures and current densities are given. In these solutions tin or insoluble anodes may be used. If tin anodes are employed, satisfactory control of the solution during plating is obtained if the anodes are suitably polarized by the presence of an oxide film. The conditions of dissolution of the polarized anodes have been examined in some detail; typical anode efficiency curves are given together with a table showing critical current densities above which polarization occurs. The requisite working conditions for plating with these "filmed" anodes are discussed. The behavior of stannate-acetate baths is shown to be similar to that of plain stannate solutions, successful operation in both cases depending upon suitable filming of the tin anodes. The effects of addition agents and chlorides in stannate solutions are considered briefly. Methods for the analytical control of the plating solutions are outlined and tests are given for the detection of impurities liable to be present in commercial sodium stannate.

The Electrodeposition of Tin from Acid Sulphate Solutions.—II. By A. W. Hothersall and W. N. Bradshaw. Transactions of the Electrodepositors' Technical Society, 1938. Pages 31-48.

The practical study of the deposition of tin from acid sulphate solutions, reported in a previous paper, has been continued by the examination of three baths of the same basic composition but containing different combinations of addition agents. The baths were worked for nearly six months and test deposits were made at intervals to determine appearance and covering power and finally to obtain results for porosity and behavior on bending. Comparative tests were also made of the effects of various sulphonic acids on the covering power and stability of the solutions and further trials of numerous organic addition agents were made. These tests failed, however, to reveal any materials superior to those used as addition agents in two of the trial baths which are recommended as simple to control and capable of yielding smooth, ductile deposits of good covering power over a long period of working without any renewal of the addition agents. Methods of preparing and controlling the bath are given in an appendix.

The Influence of Fluxes on the Spreading-Power of Tin Solders on Copper. By A. Latin. Transactions of the Faraday Society, Volume XXXIV. Part 12, December 1938.

The superior spreading power in the chloride flux may be due largely to a "tinning" action which the flux exerts on the copper, through the formation of stannous chloride by action on the solder. This action takes place with especial rapidity near the edge of contact of the molten metal and copper, due apparently to the setting up of a local "cell."

Iron is rapidly covered with a coating of tin when immersed in molten anhydrous stannous chloride at 300°C. It is thus conceivable that chloride fluxes may, after producing stannous chloride by reaction with the solder, exert a "tinning" action on the iron, thus aiding the spread of the solder in bulk. No evidence has been found, however, for the production of a local "cell" as with copper. Stannous chloride also reacts vigorously with zinc and with aluminium (in fact a mixture of stannous chloride and zinc chloride makes a good tinning agent for the latter metal).

The addition of lead to tin greatly improves the spreading properties in either flux, probably due to the lowering of the surface tension (and therefore work of cohesion). The work of adhesion does not appear to be diminished by the addition of lead. There appears to be a high work of adhesion between pure lead and copper. The fact that pure lead appears to spread better on copper in the chloride flux than in the resin flux is of some interest, as it indicates that superior chemical cleansing with the chloride flux may play some part in improving spread, since there is no evidence of an action analogous to "tinning."

Note on the Stannous Ammonium Oxalate Electroplating Bath. By A. W. Hothersall and W. N. Bradshaw. Transactions of the Electrodepositors' Technical Society 1938, pp. 49-52.

The stannous ammonium oxalate bath is inferior for general use to the stannous sulphate bath, but it is easier to prepare and may thus be useful for special purposes. The practical current density range was found to be narrow (being about 2.5-5 amps./sq. ft. in the still solution). Sound deposits are thus only obtainable where fairly regular distribution of current density can be realized. The throwing power was better than that of an acid copper sulphate solution, and the bath appeared to be stable provided the pH was not allowed to rise above about 3.5.

Post Scripts

The strain of preparing this Annual Review Issue (I hope you like it) tempted me to write "P. S. I am tired" for Post Scripts but too many interesting notes have been gathered "to remain unseen or waste their presence on the desert air." Another year has ended leaving us with mingled feelings of regret and joy—regret for the widespread strife and distress throughout the world—and joy for the measure of security that we here enjoy and for the bright prospect for the continuation into 1939 of the recent rise in business. Relegated to the limbo is the revelry of the New Year, new budgets, exchange of Christmas presents, the strains of "Auld Lang Syne" and the last installment on income tax (if you were fortunate enough to earn that much). Nicholas M. Schenck, president of Loew's Inc. seemed to be in this category with a salary of over $400,000 a year and we shed alligator tears over his recent statement during an examination before the New York State Supreme Court which was as follows, "This is very distasteful to me. With all the money you accuse me of making, I have had to borrow money to pay my taxes." Exhibit "A" of the law of diminishing returns.—On the last day of 1938, METAL INDUSTRY received a group subscription of $184 from Japan for 46 of her executives and industrial organizations. It is interesting to note that all foreign subscriptions are paid for at $4.00 a year and the issues are not sent free in order to create paper distribution. (Plug) Some of the M. I. subscriptions in foreign countries are: Australia 54, China 4, England 101, Japan 96, Manchoukuo 2, New Zealand 5, Norway 4, Union South Africa 5, Germany 11, and U. S. S. R. (Russia) 83.

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The new Japanese subscriptions to M. I. should be of interest to *A. P. Munning* of Newark who contributed to Japan's electroplating industry from 1926 to 1929 during which time he installed at Kobe a plant for manufacturing plating supplies. The two charming daughters of A. P. were born in Japan, Jane in 1927 and Jean in 1928.

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Notes from Detroit A.E.S. Annual Meeting

The movie industry would have called the annual meeting on December 10th of the Detroit Branch of the A. E. S. "super colossal."—547 at the banquet rivaling National conventions for attendance—a well-balanced show of talented entertainers including "Chaz" Chase, "the guy who eats everything" including cigars, matches, shirts with flowers for dessert. The educational meeting was opened by the Pride of Parkersburg, W. Va., *James Higgins* with *Charles Eldridge* as rapporteur—*Dr. Oliver Watts* spoke on corrosion, followed by yours truly and then a movie on "Materials."

The smooth functioning of the entertainment was due to *George Nankervis* with his usual *savoir-faire* although I noticed that George lost the perennial flower on his lapel shortly after 8:00 P.M. It was difficult not to talk shop at dinner with such illustrious table companions as *Dr. Wm. Blum, George Hogaboom, Frederick Fulforth Ray Goodsell,* (the only one present from Milwaukee), *Bill Kennedy* and the *Hoefer* brothers. The value of dinner discussions, hall symposia, or chatting with visitors at the "spa's" in various hotel rooms is inestimable and I would hazard the opinion that more plating troubles are solved and new ideas obtained from these contacts than from the formal educational sessions.

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Observed between root beers, — *C. W. Morris,* Detroit representative of Bias Buff and Wheel Co. as host to two of the four *Nagle* brothers from Toledo, namely *James* and *Dick Nagle* with the *Mrs. Nagles* who looked more like debutantes than the mothers of five and six children respectively—*Thomas Slattery,* one of the many devotee's of airplane travel who stated that he and his brother *John J.* were part of a father and son team in electroplating as they followed the plating footsteps of their father *John W. Slattery—Dick Crane* and *Earl Couch* the Lea Twins looking for dancing partners—

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The Electrochemical Society is planning a Scandinavian trip in 1940 probably on the Oslofjord and I have reproduced a scene which the members of this trip will see

Scene near Bergen, Norway, which will be seen on the Electrochemical Society's Scandinavian trip in 1940

outside of Bergen, Norway en route to Odda in Hardangerfjord. The scenery in Norway is unbelievably beautiful and this scene is typical of the general scenery. I snapped the picture late in the afternoon on April 1st using a 4.5 lense 9 x 12 cm. plate camera. The ruggedness of the vikings is easily understood when we see the type of terrain from which they had to obtain their existence.

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This "family" showed strong traits of independence.

A census taker asked the woman at the door: "How many in your family?"

"Five," snapped the answer. "Me, the old man, kid, cow and cat."

"And the politics of your family?"

"Mixed. I'm a republican, the old man's a democrat, the kid's wet, the cow's dry and the cat's a Mormon."

Perhaps the Author of This Definition Studied Electroplating In the Sunday Magazine Sections

Dear Walter:—

The following definition of "Electroplating" appears in the "Standard American Encyclopedia", published by the Standard American Corp., Chicago, Ill. I noticed this in one of the volumes on sale at a drug store. I believe this encyclopedia is also the one being given away "free" by the newspapers, for so many coupons, (and 49 cents).

"ELECTROPLATING. A means of covering a metal or metallic surface by exposure in a bath of a solution of a metallic salt which is decomposed by electrolytic action.

"The process used for electroplating is in general as follows: either a vat or non-conducting material is used with a metallic electrode, or a metal vat is used, the vat itself acting as an electrode. A solution of a salt of the metal used for plating is put in the vat and as a NEGATIVE ELECTRODE IS USUALLY USED A PIECE OF THE METAL BEING PLATED, for copper plating a solution of blue vitriol or copper sulphate is used with a NEGATIVE ELECTRODE OF COPPER. The POSITIVE electrode is the ARTICLE BEING PLATED. A source of direct current either a battery or dynamo, is connected to the electrodes with regard to the polarity mentioned, namely, POSITIVE to the article being plated and NEGATIVE to the other electrode. THE NEGATIVE ELECTRODE ATTACHES ITSELF IN ATOMIC FORM TO THE ARTICLE BEING PLATED."

The use of a tank as a soluble electrode, not to mention the connections mentioned, constitute probably the neatest trick of the week.

The definition reminds me of the nickel anode salesman who used to go around the shops in New York and bowl them over with a positive guarantee that his nickel anodes would last longer than any other anodes on the market. Needless to say he was probably 100% correct. Sincerely,

Byron Hogaboom.

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I am indebted to *Frank Watt* of Frederic B. Stevens Co. for the following poem, and "Ain't it the truth though."

The Morning After the Night Before:

Here I lie upon the bed,
Throat so dry and throbbing head,
Blood-shot eyes and body sore,
The morning after the night before.
Can't eat nothing—got no pep,
Lost my money, lost my rep,
Can't get up, I feel so bad,
Boy: What a wonderful night I had.
Never felt so bad before,
Even my darned tongue is sore.
When I sneeze I still taste gin,
Gosh! What a night it must have been.
Can't remember where I went.
Don't know where the time was spent,
But Wow! What a time it must have been
Look at the hellava shape I'm in.

• •

T. C. Eichstaedt reports that grey iron castings can be pickled better in a hot solution (180°F) of a mixture of sulfuric and hydrofluoric acids than in either acid separately. A 20% solution, 1/3 sulfuric acid and 2/3 hydrofluoric acid is recommended.

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I was surprised on December 15th to hear on the phone the pleasant English voice of *E. J. Dobbs*, Chief Engineer of Canning & Co., Ltd., of Birmingham, England. We spent two hours at lunch discussing plating in America as an Englishman sees it and vice versa. Mr. Dobbs, in company with *V. B. Stemp*, Electrical Engineer of Canning's visited plating plants in Waterbury, Trenton, Akron, Cleveland and Detroit and said he received very courteous receptions wherever he went. Messrs. Dobbs and Stemp were dinner guests of *Van Winkle Todd* and *Charles Yerger* at the New York Princeton Club on Wednesday, December 14th, the next evening were guests of *K. Schwartz* of United Chromium, and on Friday they returned to England on the Queen Mary.

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Thumbnail Biography — Benjamin H. McGar

Benjamin H. McGar has been an active worker in the American Electroplaters' Society, serving on the Research Committee

and presenting numerous addresses before various meetings of the Society.

He was graduated as a Chemical Engineer from Wesleyan University in 1916 and from 1916 to 1918 worked as an Analytical Chemist at the Chase Metal Works.

From 1918 to 1923, he was Chief Chemist at the Bristol Brass Corporation and from 1923 to the present time he has been Chief Chemist and Assistant Director of Research at the Chase Brass and Copper Co., Waterbury, Connecticut.

In addition to the A. E. S., Ben belongs to the American Chemical Society and the Electrochemical Society.

Some of his publications are: "Copper and Its Alloys—Their Development and Uses", "Annealing Brass and Copper in Controlled Atmospheres", "Finishing Operations on Copper and Brass Sheet", "Sheet Brass for Photo-Engraving and Etching", "Lubrication of Metals for Fabrication and Cutting".

One of his outside activities is the office of Secretary and Treasurer of the Board of Water Commissioners of Southington, Connecticut.

One problem of greatest interest to Ben in the Non-Ferrous industry is lubrication and lubricants. In addition, he devotes all his possible spare time to reading mostly history and biography.

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Austin Wilson, *Burt Daw* and several others were overheard discussing the merits of music for waltzing, fox trotting, and swing for A. E. S. dances and it was agreed that swing should be left for the "Jitterbugs" and only music played at the dance with a waltz every third song. Most of the people attending A. E. S. dances are not in physical condition to withstand being worn down by that "Frankenstein" of music, swing, which should be left to high school dances or dance hall athletes. At a recent A. E. S. dance at which a swing band performed, most of the dancers retired to the tap-room to sit the music out—whereas the music at the annual convention in Milwaukee in 1938 of Heinie and his Grenadiers, sans swing, was the most thoroughly enjoyed music of any convention in many years.

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Our recent letters to *Bert Sage*, addressed to Boston, were returned and we learned that he had taken a new position at Olean, New York with the Daystrom Corporation, manufacturers of Chrome Furniture. I am reproducing part of Bert's letter to me which was sent in answer to my inquiry whether he would continue his A. E. S. activities. I am doing this without Bert's permission as I know, that if he were asked, he would refuse out of modesty.

The letter typifies Bert's sincerity and lack of ostentation.

"Dear Walter:

"Yours of the 23rd inst received, I am surprised that you should imagine for one moment that I would not continue my activities in the A. E. S. right or wrong; Walter the A. E. S. is part of my life perhaps I should go so far as to say it is my Hobby.

"Sure I read your Post Srips column. (Darn this Pandoras Box of Miss spelling) to prove it, there are some organizations, whom are bothered with spotting out, and cannot afford to Vapor Degrease so why not for their benefit suggest that a steam bath be installed, in which the work after being Plated is placed for a period of time, the object being to my mind, to have the steam penetrate, all those Foolish Pores, of the Base Metal where, the whole story of spotting out is written, that is just a suggestion, Walter, but if you care to use it do not mention it as my suggestion, but I would like to know what results would be obtained.

"I guess I am late in Wishing You Nothing But Success in your new Position, but darn you I will have to buy a dictionary, to find out what that word Matriculation means, perhaps you think I need a dictionary any way, but I blame my spelling onto the keys of this instrument for which I have only one finger that functions whereas I understand it was made for five, or even ten, but one is my limit, even as bad as this may be if you were to receive a letter from me in long hand you would have to go

to secret service department to have it deciphered. Yours,

Bert Sage."

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Dear Bert—I have had the same trouble using the "hunt and peck" system when typing. Best wishes on your new job.

Sincerely, W. R. M.

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Walter Barrows has attended every annual convention of the American Electroplaters' Society but one, and the letter which follows is in answer to our inquiry as to the reason why he did not attend the 1917 meeting. The letter illustrates Mr. Barrows' seriousness in his work and is indicative of the reason for the high regard with which the members of the Society hold him:—

"Dear Dr. Meyer:—

"Attending conventions of the American Electroplaters' Society has always appealed to me as more or less serious business, I have never allowed convivial attractions to interfere with the real purpose of my presence. Regardless of sponsorship, whether personal, as A. E. S. delegate or otherwise, I have made good use of pad and pencil during and after all sessions whether educational, business or social. One year a member of a Branch located in the U. S. was present at the Toronto Branch meeting at which I presented my report as Delegate to the convention that year. My report filled twenty-two type written sheets and included frequent injection of unwritten explanatory remarks. After finishing the report and answering numerous questions I was surprised to see the visiting member rise and ask if such reports were required of Toronto delegates. Then he said: 'I have been a member of the A. E. S. since the formation of our Branch but I had to come to Toronto to hear the first worth while report of a convention.'

"Yes, I have attended every convention of the A. E. S. except St. Louis, Mo., in 1917. I was then engaged in experimental electroplating and research work for a large Canadian Smelting and Refining Company. We were just finishing some very important experiments and the demands of war made it necessary for me to continue the work rather than attend a convention. I have always regretted that because it was at the St. Louis meeting that I was presented with a beautiful address on vellum leather inscribed in gold lettering.

"Every member of the A. E. S. should attend the annual meetings, not for a week of "Whoopee" but for real honest-to-goodness inspiration and reliable information regarding the various phases of metal finishing.

Faithfully yours,

Walter S. Barrows."

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John R. Gumm of Fred. Gumm Chemical Co., had his car stolen at Newark, N. J. on November 15th and it was found on December 21st at Collegeville, Pa.

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Frederic H. Emery, Chemist of Harshaw Chemical Co., Cleveland, Ohio emulated Mr. Moto and Charlie Chan by his recent spectrographic detective work in which his analysis of cement particles led to the conviction of two safe-blowers. The mystery of who painted Plymouth Rock has also been solved by the use of the spectrograph. Spectral lines might be called "atomic fingerprints".

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Clinton DeBaun

Clinton DeBaun has been engaged in the sale of lacquers for 43 years, up to his retirement on February 15th from the Egyptian Lacquer Manufacturing Company.

Mr. DeBaun joined the Egyptian Lacquer Company in the capacity of bookkeeper and worked in the office as such for several years until he was promoted to the sales organization, of which he has been a member continuously until his retirement.

Many are the interesting yarns which Mr. DeBaun could spin about the early days of the lacquer industry and if you want to have an enjoyable time, visit him at his home in Woodcliff, New Jersey, and get him to tell a tale or two about the days when lacquer was in its infancy. He has kept himself busy

around his home and grounds taking care of his flower and vegetable gardens and doing the many things for which he did not have time when busy with the sale of lacquer. Mr. DeBaun's many friends wish him continued happiness and good health in his retirement.

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Several more father and son teams in electroplating have come to our attention since the November issue, namely—*Richard C. Mahoney* and sons *Harold* and *Lawrence*; *J. J. Siefen* and sons: *Robert Steuernagel Sr.* & *Jr.*; *John Miszewski Sr.* & *Jr.*; *John Geissman* and son *William C.*; *Ray Goodsell Sr.* & *Jr.*; *James Nagle* and sons *James, Richard, Edward* and *Donald.*

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S. E. Hedden reports that the Pittsburgh branch of the A. E. S. was visited by *Dr. W. Blum* on Nov. 17th and on Dec. 2nd were given a talk on solvent degreasing by *Dave Willard* and *George Walter* of Detroit Rex Products Co. A working model and colored movies were used in the talk. *Richard Hummel* of Harshaw Chemical Co. is hard at work getting new members.

The most appropriate Christmas card was received from *Walter G. Bullard* of United Shoe Machinery Co., Beverly, Mass. which consisted of a sheet of buffed copper with the inscriptions tooled on it. Thank you Walter and I hope I can find time to join you on some of your future White Mountain hikes.

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Christmas Greetings Were Received from the Following:

The Agate Lacquer Mfg. Co.
Anonymous (Several)
Edgar G. Behr
Edward Berry
Dr. William Blum
Walter G. Bullard
Ellsworth Candee
H. Tom Collord
Earl Couch
Fred Fulforth
Dr. Kenneth Graham
Fred Gumm Chemical Co.
Hall Laboratories
Handy and Harman
Derrick Hartshorn, Jr.
S. E. Hedden
George B. Hogaboom
Gerald King
George Knecht
Bob Leather
Charles F. L'Hommedieu & Sons
Franklyn J. MacStoker
John Oberender
J. P. Orben
Charles E. Proctor
Philadelphia Quartz Co.
Joseph P. Sexton
Charles Schwartz
Thomas Slattery
Frances Suarez
O. S. Tyson & Co., Inc.
Frank Watt
Austin Wilson

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A reporter on the *New York World-Telegram* either mixed his metaphors or studied at the same school as the author of the definition on electroplating mentioned in this column as attested by the following excerpt from his December 26th story on a transformer explosion in Wall Street: "The transformers are used to change alternating current to direct current." This reminds me of the story of the medical student who was asked during an oral quiz what the cure for epilepsy was and after hesitating several minutes, replied that he knew the night before but had just forgotten it. He was squelched by the Professor's remark that medical science had been looking in vain for a cure for hundreds of years and medical investigators would be grateful if the student could only remember the cure he had just forgotten. Perhaps the *World-Telegram* reporter will explain how to change A. C. current to D. C. using transformers so that we won't have to bother with rectifiers or motor-generator sets.

HAPPY NEW YEAR

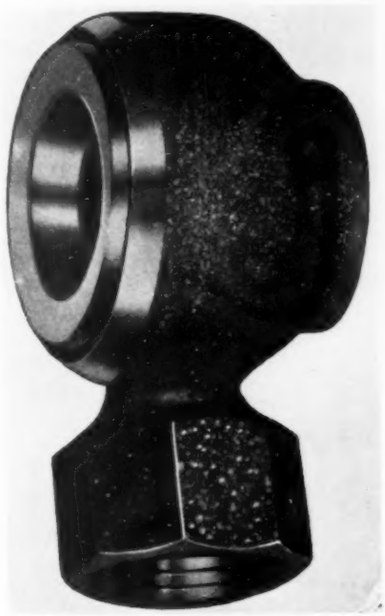
Walter R. Meyer

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Spray Nozzle

Spraying Systems Company, 4922 W. Grand Ave., Chicago, Ill., has placed on the market a non-clogging spray nozzle, called "Parasol." Spray is the hollow cone type with uniform distribution and exceptionally wide spray angle. These "Parasol" nozzles are said to be of sturdy construction, accurately machined, and are now available with female pipe connections ⅛" to ½". Capacities range from 0.5 to 4.0



G.P.M. at 10 pounds pressure. Standard stock construction is brass; other metals can be specified.

The nozzles are to be used for air conditioning, air washers, air coolers, brine spraying, chemical processes or wherever an exceptionally wide spray angle is required.

New Stripper for High Baked Enamels

The Enthone Company, 442 Elm Street, New Haven, Conn., has announced the development of Enthone Baked Enamel Stripper for rapidly removing high baked synthetic enamels from all types of base metals, such as magnesium alloys, zinc base die castings, aluminum and steel without etching or attacking them. It is claimed that these base metals, after stripping of the enamel, are left clean and bright without deposition of pigment or etching such as results from the use of caustic stripping solutions. The stripper is said to be non-caustic, is used diluted with water, and completely removes the enamel in from one to three minutes.

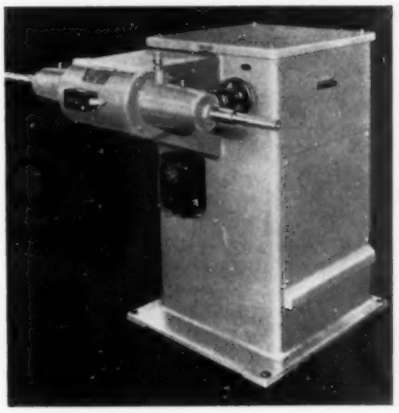
The manufacturers state that Enthone Baked Enamel Stripper has been in industrial trial use for over a year with economy of material and labor savings due to elimination of hand wiping, wire brushing and polishing which were necessary when alkaline strippers were used.

Variable Speed Lathe

The Crown Rheostat & Supply Company, 1908 W. Maypole Avenue, Chicago, Ill., has incorporated variable and instant speed change into its standard long-overhang polishing lathe, which is said to eliminate wrench adjustments.

Scratch brushing, buffing and polishing can be performed as desired since the change from one speed to another requires but a fraction of a minute. By merely turning the hand wheel, variable speeds ranging from 870 to 3,050 R.P.M. may be obtained.

The lathe is equipped with a 14-inch overhang allowing greater freedom in the handling of large and bulky pieces. Another feature is its base of welded steel construction which permits greater control of weight distribution and balance. The spindle, due to its position, is readily accessible and servicing is a simple matter. The standard unit operates from a "V" drive belt at 5 H.P. although other horsepowers can be furnished.



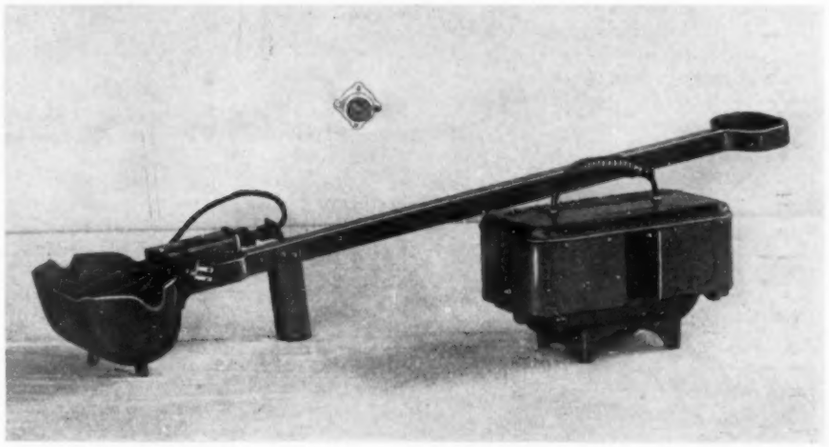
New Variable Speed Lathe.

Portable Ladle

A new portable ladle has been developed by T. M. Chapman's Sons Co., Old Town, Me., for melting of metal directly at the job. The following advantages are claimed for this method of melting over the old way:

It is impossible to burn or destroy the bearing metal by overheating. The temperature will not exceed approximately 900°F. no matter how long the current is left on the heating units.

The ladle, while in use, is surrounded by heat insulating jacket. There are no ashes or coal dust to get into the metal and there are no gases produced to be absorbed by the metal. Furthermore, the metal is not exposed to the outside atmosphere but is melted inside a heat insulating jacket.



Portable Electric Melting Ladle.

New Universal Spring Coiling Machine

Sleeper & Hartley, Inc., Worcester, Mass., manufacturers of wire working machinery and wire mill equipment announce the development of a new wire coiling machine, reported to possess many features which result in increased economy of manufacturing.

In case of a change or special spring, both pitch and diameter cams may be shaped, timed and affixed to the cam-hub which, as an entire single unit, may be removed from the shaft. One-piece solid

Universal Segment Type Spring Coiling Machine.

cams may be used on this removable cam-hub. Other convenient controls include: individual pressure for each pair of feed rolls; individual simple adjustment for cutter alignment instantly adjusted from upper to lower cutter shaft; micrometer adjustment of compound blocks and pitch-stop conveniently located and quickly adjustable.

This machine will coil and cut all kinds of compression and extension springs including: open and close-coiled springs; right and left hand springs tapered one or both ends; two-diameter springs, coned springs with any degree of taper; coned springs with variable pitch; barrel-shaped springs; lays one or more close-wound coils at one or both ends of any type of spring.

Special tooling may be applied for use of square or rectangular wire.

New Multi-Edge Anode

A new Multi-Edge anode has been announced by Republic Lead Equipment Co. It is a double or two-faced anode, with rectangular ribs on both sides, for plating from two sides of the anode when a center anode rod is used in the tank.

The single Multi-Edge anode, with ribs on one side only, is for use on side anode rods. First introduced to the trade in 1936, this is claimed to have been the original anode of its type and has met with widespread acceptance in large and small plants throughout the country.

All hooks on both types of Multi-Edge anodes are made to fit the customer's specifications—either flat or knife edge. At no extra cost, the hooks can be made to fit round, rectangular or square rods. If the

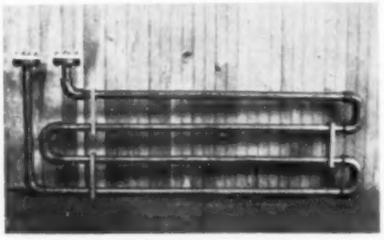
Multi-Edge Lead Anodes for Chromium Plating.

distance from the solution level to the top of the anode rod is known, the manufacturer can furnish hooks of the proper length—even if a very high solution level is maintained.

Further details and prices may be obtained from supply houses or by writing directly to Republic Lead Equipment Co., 7928 Jones Rd., Cleveland, Ohio.

Heating Coils for Acids

Heil and Company, 3088 W. 106th Street, Cleveland, Ohio, have developed a line of chemical resistant devices called "Nocorodal." These devices are constructed of an



impervious carbon compound and are claimed to be practically unattacked in hot muriatic, hydrofluoric and phosphoric acid baths.

Nocorodal coils are recommended for heating mixed acids and particularly the acids used for stainless steel pickling. The heat conductivity of this material is claimed to be in between that of steel and copper.

Rapid Grinder

Gaston Power Tools, 2657 W. 95th Street, Evergreen Park, (Chicago), Ill., have developed a new type of portable disc grinder and sander which is powered by a new type of motor for portable tools. This sander has no gears and only two bearings. The motor is the induction type with no commutator and no brushes. The winding is enclosed in a dust tight case.

Two sizes are built; one horse-power for the heaviest kind of grinding and sanding; one-half horse-power for light duty. Each

Portable Disc Grinder and Sander.

size is said to be capable of 100% overload momentarily. They are made for the regular 220-volt, 3-phase, 60-cycle power circuits.

Self-Lifting Steam Gun

A highly improved steam gun, reported to represent a marked advance in this type equipment, has been announced by Oakite Products, Inc., 14 Thames St., New York, N. Y.

In addition to incorporating the advantages of light weight and ease of use, the basic improvement of the Oakite Steam Gun

Use of New Steam Gun.

(patent applied for) is its self-lifting feature. This new gun automatically lifts the cleaning solution from floor level to a height of over 10 feet without the aid of pumps, injectors, means of gravity feed or other auxiliary apparatus, and delivers a most effective wet spray on the surfaces to be cleaned. All that is needed to operate the gun according to the maker, is the necessary steam and solution hoses, steam supply, and an open top drum or other easily obtainable open solution container.

To meet individual requirements, the gun is manufactured in two different sizes. Equipped with an air-cooled handle, the small unit, Model No. 384, which is 3½ feet overall length and weighs 5¾ pounds, is designed for cleaning automobile trucks, tractors and similar types of equipment; for cleaning machinery, equipment, floors, etc. in metal working plants. The large unit, Model No. 385, is 7½ feet overall length, weighs 13¼ pounds, and is designed for use on the heaviest steamcleaning operations where a long gun is required to reach the highest parts being cleaned.

Cast an eye upon these

SMALL PERCENTAGES

1½% High-speed, precision worm gears withstand extreme pressure and temperature when cast in 1½% Nickel bronze, says Baush Machine Tool Co., Springfield, Mass. Chilled at periphery, Nickel bronze provides increased hardness where stress and wear is greatest. For strength and toughness in bronze castings subject to unusually high stresses, use Nickel.

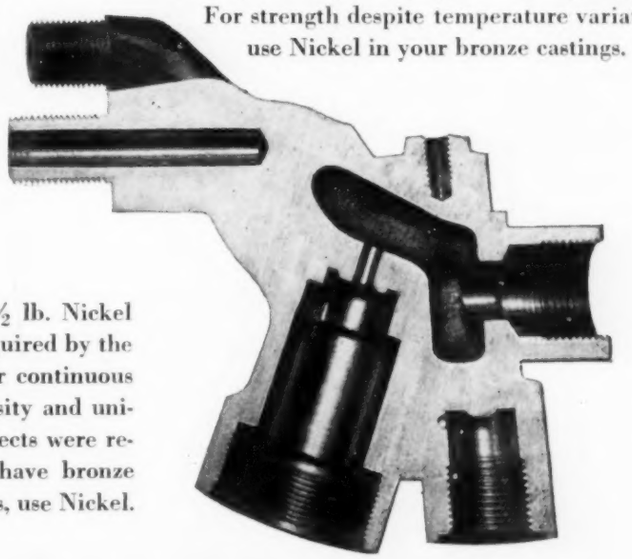
. . . a little

CAST NICKEL BRONZE

helps a lot

1½% G-E oil-cooled transformer parts must stay oil tight hence all bronze castings used (example pictured above) are given a hydrostatic pressure test. For these castings the General Electric foundry at Pittsfield, Mass., add 1½% Nickel to their regular 85-5-5-5 mixture. In one run of 120 castings every part was oil tight after machining. For uniform structure and continued pressure tightness in bronze castings, use Nickel.

1% Locomotive boiler feed pumps must withstand shock, wear and pressure at varying temperatures. These 1% Nickel bronze feed pumps (left) were cast by Textile Machine Co., Reading, Pa., for J. S. Coffin Jr. Co., Englewood, N. J. Tested to 400 p.s.i., "proved satisfactory in every way", says consulting engineer. For strength despite temperature variations, use Nickel in your bronze castings.



1% Seven twisting water passages in a 2½ lb. Nickel bronze casting (right). That was the job required by the Ritter Dental Mfg. Co., Rochester, for their continuous flushing cuspidor. By using 1% Nickel density and uniformity were so improved that foundry rejects were reduced, machining costs lowered. Do you have bronze problems? For uniformity in bronze castings, use Nickel.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

INTERESTING CLEANING DISCOVERIES THAT LED TO IMPORTANT PRODUCTION SAVINGS

ALUMINUM CASTINGS
THE PROBLEM
To thoroughly clean buffed aluminum castings without tarnishing or spotting . . . at less cost.
THE ANSWER
A simple 1-minute dip in a cold-tank solution of MAGNUS No. 78 and water followed by a cold water rinse.

The above actual case history shows how MAGNUS EMULSION DEGREASING SOLVENT No. 78 enabled a large Eastern manufacturer of electrical appliances to completely eliminate hand scrubbing from cleaning buffed aluminum castings. Previous to using MAGNUS No. 78, more labor was required on that one time-wasting, profit-eating item than on any associated operation in the production line. MAGNUS No. 78, used *cold, completely eliminated* that expensive item and, in addition, showed other important savings.

HAND SCRUBBING ELIMINATED

Let us show you how MAGNUS EMULSION DEGREASING SOLVENT No. 78 will cut your cleaning costs, give you brighter, better-cleaned castings . . . and otherwise materially increase your profits. Write today for a MAGNUS SERVICE MAN to give you a demonstration *under your own working conditions.* Or, send us the details of your cleaning operations for our specific recommendations.

A DEFINITE DAILY SAVING IN THE COST

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

11 South Avenue Garwood, N. J.

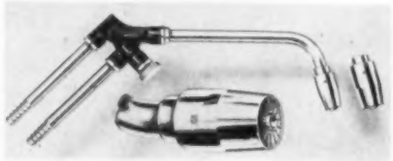
MAGNUS CLEANERS

Blowpipe with Radial Grid Tip

A blowpipe with a radial tip operating with manufactured or natural gases is manufactured by the S. S. White Dental Mfg. Co., Industrial Division, 10 E. 40th St., New York City.

The illustration shows the S. S. White No. 8 blowpipe a high intensity gas and air torch for general purpose soldering, brazing, etc. This blowpipe is claimed to possess a number of novel features which give it a high efficiency to make it easy and comfortable to use. The carburetors are supplied in different sizes for different types of gases and each carburetor is so constructed that any increase of the flow of air at the bench connection automatically increases the flow of gas from the main line.

Two readily interchangeable radial grid tips are available. The smaller, supplied as

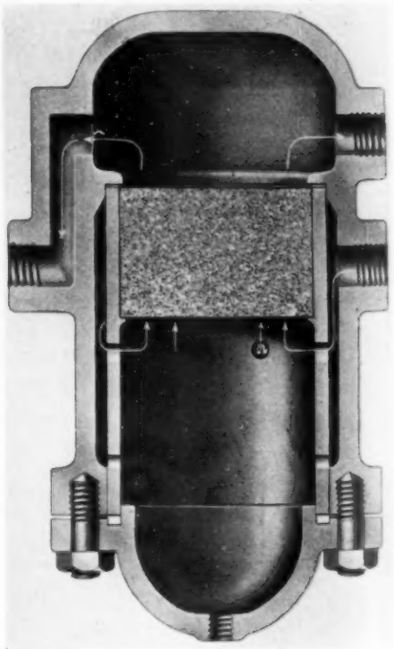


standard equipment, is suitable for all ordinary soldering and brazing operations. Its flame can be held to a fine needle point or increased to a strong blast. The larger tip is for use where large quantities of alloys must be rapidly melted. The unique design of the tips, it is said, causes two concentric flames to be produced: a strong, cone-like inner flame, and a distinct outer flame that acts as a pilot light. No matter which gas or gases listed herein are used, and no matter what type of flame is required, the flame produced by the S. S. White No. 8 blowpipe is said to be clear and definite. It will not sputter or blow out at any working air pressure. Moreover, it will produce an exceedingly effective reducing flame that is very desirable for keeping the metal free of oxides when soldering and brazing.

New Air Filter

New filters, designed to meet the increasing demand for a highly efficient filtering device in gas and air lines, have been developed by the Fisher Governor Co., Marshalltown, Iowa. These new Fisher types 360 and 361 filters, it is said, remove foreign matter and separate free moisture from the air and gas pipe lines with a minimum friction loss. They protect expensive air tools, machines, instruments and other devices against damage and costly service interruptions, while guarding and improving the quality of the finished product.

Fisher filters utilize extremely hard aluminum oxide crystals bonded together as a filter element. This especially manufactured filter element is both acid and heat resisting, and unusually strong. Gases pass



New Air Filter.

through this porous filter with only slight loss due to friction.

The filters may be installed in either vertical or horizontal pipe lines with standard pipe fittings. They are unusually compact. Their advanced design separates free moisture before gases pass through the element. This reduces the load and results

in longer service life and less frequent cleaning. Suitable drain cocks are furnished. Flanged and bolted bottom castings permit easy, quick removal for cleaning.

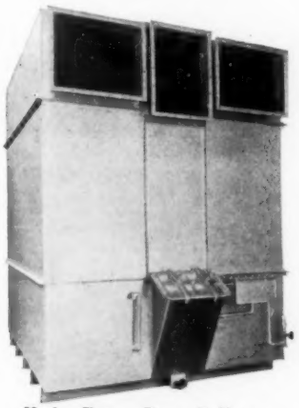
Complete information about these filters is contained in Fisher catalog No. 1, a copy of which may be obtained upon request from the above company.

Address of U. S. Stoneware Co.

The address of the U. S. Stoneware Company which was omitted from the December issue, is 60 East 42nd Street, New York City. This was in connection with the new materials offered by the U. S. Stoneware Company for lining tanks. These materials included "Tygon," which is claimed to be entirely resistant to attack by hot oxidizing agents, such as nitric acid, as well as hydrofluoric, alkalies, hydrocarbons and most solvents.

Dust Collector

R. C. Mahon Co., 8700 Mt. Elliott Ave., Detroit, Mich., has announced the new Mahon Hydro-Foam dust collector. This device, employing, it is said, an entirely new principle of dust removal and collection, has no cloth screens to remove or replace, no water pumps to wear out, no nozzles or jets to replace or keep in alignment. The only moving mechanism in the entire system is the suction exhaust fan which is located on the outlet side and handles only clean air.



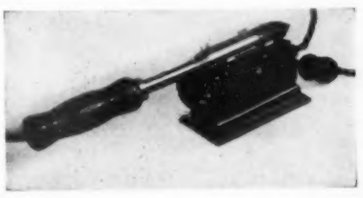
Hydro-Foam Dust Collector.

The system is entirely pneumatic. The liquid solution is maintained at the proper level automatically. The Hydro-Foam eliminating process is achieved through the action of the air on the surface of the solution and in the Hydro-Foam chambers. The dust is removed from the air and retained in the collector in the form of a sludge, which can be removed either manually, through clean-out doors, or automatically by means of an inclined screw conveyor.

Mahon Hydro-Foam units are manufactured in standard sizes of various capacities and can be used singly or in multiple to meet any industrial requirement.

Soldering Instrument

Soldering irons of any size or make are kept, it is claimed, at a constant, adjustable temperature by the soldering iron stand with



automatic heat control pictured here, of the American Solder & Flux Co., 4519 Wayne Ave., Philadelphia, Pa. Unit consists of a base containing an automatic thermostatic switch which consumes absolutely no current, and a simple bracket attached on top of this base to hold the iron. The soldering iron is laid on the stand, its heat is held at a constant temperature until removed, at which time full current is automatically turned on. The unit is readily portable and is installed by merely plugging its extension cord into any outlet.

This device will, without adjustment, handle all irons up to 2000 watts in 110 or 220 volt alternating current and up to 500 watts direct current.

Industry Comments Upon

ROBINSON'S ASSAYED GOLD PLATING SOLUTION

(from actual letters in our files)

"We like your solution. We like your free analysis service. We never quite knew where to go with our plating problems."

"I am amazed at its speedy and high throwing power."

"When I used to cut down my own gold, I never had time for improving my technique, or attending to other profitable work."

"We always look favorably on modern methods. Certainly home-made solution is behind the times."

"We have figured out that it costs no more, and besides we now have a large office desk and a file in the space where we used to make our own solution."

"What a relief from those acid fumes. That alone is priceless."

The larger your gold consumption, the more your need for prompt investigation of Robinson's Solution. But no order is too small for our prompt attention.

Users of ROBINSON'S ASSAYED GOLD SOLUTION get free analysis service on all kinds of plating baths, and general advice on plating problems. Direct inquiries to the firm, attention of Dr. C. B. F. Young, chief research chemist.

A. ROBINSON & SON

"Sixty years at Precious Metals"

131 CANAL ST. NEW YORK

Assayers and Refiners of Precious Metals—Gold recovered from discarded solutions — Fine Silver Anodes.

CHROMIC ACID

Recognized as the world's largest manufacturer of chromium chemicals, Mutual brings to the plating industry a basic source of chromic acid.

Our facilities cover every step in its production, from the mining of the chrome ore on a remote island in the Pacific to the wide distribution of the finished product through warehouse stocks in the principal consuming centers.

MUTUAL CHEMICAL CO. OF AMERICA — MUTUAL — NEW YORK, N.Y.

CHROMIC ACID
OXALIC ACID
BICHROMATE OF SODA
BICHROMATE OF POTASH

Mines in New Caledonia
Plants at Baltimore and Jersey City
Warehouse stocks carried in all principal cities.

MUTUAL CHEMICAL CO. OF AMERICA
270 Madison Avenue, New York City

New Buffing and Polishing Lathe

The Hammond Machinery Builders, Inc., 1601 Douglas Ave., Kalamazoo, Mich., have added a new polishing and buffing lathe to their line of polishing and buffing equipment, Type "R" Rite-Speed, which will accommodate motors up to and including 3 H.P., 60 cycle, A.C., for lighter duty. The largest 25 cycle motor, however, that can be used is 2 H.P. The spindle is 45" long overall and operates on two high-grade ball bearings. It is driven by "V" belts from the motor which is mounted inside of the base. Standard equipment includes push button control with starter, having overload and low voltage protection and spindle lock to hold spindle when changing wheels.

This new lathe weighs 475 pounds and it is stated will be of interest to concerns doing light polishing or buffing; also to concerns in 25 cycle areas as owing to the V belt drive from the motor in the base, an efficient spindle speed may be had regardless of slower speed 25 cycle motors.

New Buffing and Polishing Lathe.

Zinc Coating for Painting

A new kind of galvanized sheet metal with a special phosphate coating bonded with the zinc marketed by The American Rolling Mill Co., Middletown, Ohio, is said by highway maintenance men to promise longer life and greater economy in highway signs.

Advantages of the new sheet metal are said to be greater paint adherence, lower initial cost, and greater resistance to sharp blows of flying stones or the "practice bullets" of traveling sportsmen. Signs made of Armco PAINTGRIP, as the metal is called, are also said to remain legible and attractive longer than signs made of ordinary galvanized metal.

The special surface of the sheet gives greater paint adherence and insulates the paint from the drying-out effect of zinc, according to The American Rolling Mill Company. PAINTGRIP sheets are said to be comparatively inexpensive. Spalling or powdering of some galvanized sheets during fabrication of signs, often encountered by fabricators, are said to be eliminated by the use of this metal.

The new sheet metal already is being used widely for commercial signs, heating and ventilating ducts, shower stalls, truck bodies, gutters and downspouts and similar applications where an immediate coating of paint and long attractiveness are desired.

Brush Electroplater

The Rapid Electroplating Process, Inc., 1414 S. Wabash Ave., Chicago, Ill., announce for sale, a new device for electroplating metals, such as nickel, copper, brass, cadmium, tin and silver from jelly-like solutions. It is claimed that plating can be applied upon all metals except chromium and aluminum, the only requirement being that the surface be free of lacquer, rust, grease or dirt. The current for plating is supplied either by ordinary dry cells or a transformer-rectifier which plugs into any 110 volt A.C. circuit.

Method of Plating Typical Articles.

Entire surfaces can be plated but the chief use of the process is in repair of worn spots on plated articles. Any desired thickness of plating can be obtained.

The outfit is called the Rapid Electroplater and comes in a wide range of kit sizes, suitable for homes, workshops and industrial users.

HANSON-VAN WINKLE-MUNNING

Motor Generator Sets (complete)

10000 Amperes, 12 Volts, 300 R. P. M. Generator
and 7500 Amperes, 12 Volts, 300 R. P. M. Generator

both driven by

Westinghouse Synchronous Motors

each with its own

Motor Generator Set Exciter

and

Westinghouse Distributing Panel & Starter

●

Chandeysson 5000 Amperes, 9 Volts, 300 R. P. M., M. G. Set
Synchronous Motor Direct connected Exciter and Panel

●

A large Assortment of Varieties and Sizes

Let us know what you need and we will quote nearest we can offer

We have no list

PAN ELECTRIC MFG. CO.

Gravois & Bingham Aves.

St. Louis, Mo.

Paramount

felt polishing wheels

Manufacturers Since 1824

Will Do It Better

Some of our customers have used felt polishing wheels for over thirty years. They will tell you they have tried all types of polishing wheels during this time but they still find, for that superior polished surface, a felt wheel still does it better and cheaper.

You will have the same results if you try Paramount Brand Felt Polishing Wheels. Ask your plating supplies salesman for them.

Paramount Brand Felt Wheels Just do it Better

BACON FELT COMPANY

WINCHESTER, MASS.

Manufacturers' Literature

Industrial Ovens, Dryers and Heaters. Catalog No. 2, describes and illustrates Gehnrich & Gehnrich industrial ovens, dryers and heaters. Over a period of more than fifty years the company has introduced the insulated steel wall panel, indirect heating and the conveyor oven. Their most recent development is the D.J. direct atmospheric gas recirculating type air heater, patented in 1936. Gehnrich & Gehnrich, 32-32—57th Street, Woodside, L. I., N. Y.

Abrasive Blasting Equipment. Catalog No. 212, illustrating and describing the latest models of the Tum-Blast and also containing sections devoted to the Wheelabrator Tablast and Wheelabrator special cabinets. American Foundry Equipment Co., Mishawaka, Ind.

Indicating, Recording and Controlling Instruments. A folder illustrating the Brown line of indicating, recording and controlling instruments for measuring and controlling temperatures, pressures, flows, liquid levels and humidity. Brown Instrument Co., Philadelphia, Pa.

Buffers and Grinders. Bulletin 104, describing and illustrating the new line of Cadet buffers and grinders. Standard Electrical Tool Co., 1938 W. 8th St., Cincinnati, Ohio.

Dust Problems. This is the third in the series of Dust Hog Mailings, bringing dust problems before industry without damaging references to harmful hazards. The Pangborn Corp., Hagerstown, Md.

Rust Prevention for Iron and Steel. Parkerizing. Improvements in this process are said to include: shortened processing time, lower operating temperature, improved chemicals, smoother coating, etc. The catalog is attractively bound and well illustrated. Parker Rust Proof Co., Detroit, Mich.

Unit Heaters. Bulletin S 327, August 1938. Illustrating and describing the modern Trane methods of cutting heating costs. The Trane Co., Lacrosse, Wisc.

Powder Metallurgy. Folder describing and illustrating a new plant which has facilities now available for powder metallurgy operations. Powder Metallurgy, Inc., 42-41 Crescent St., L. I. City, N. Y.

Drum Making Machines. Bulletin No. 82 covering the methods and machines used in making steel drums, pails and containers, including production flow charts, showing typical set-ups of machines, etc. Well illustrated. Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y.

New Arc Welding Technique. Bulletin 412-A. Covering the new Lincoln *Shield-Arc* welder with self-indicating dual continuous control. Illustrated. The Lincoln Electric Co., Cleveland, Ohio.

Air Switches. Bulletin 517. Covering air switches for local or remote control manually. These switches are available for the control of either electrically or air-operated valves. The Bristol Company, Waterbury, Conn.

Dust and Fume Sampler. Bulletin CT-2. *M.S.A. Electrostatic* dust and fume sampler designed for quantitative sampling and employs the principle of pre-ionization with electrostatic precipitation. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

Welding Procedures. A bulletin on arc welding electrodes and accessories with procedure for welding of various metals. Illustrated. Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Quick Baking Synthetic. Vitra-Carlite. Bulletin No. 21, giving information on this high temperature, short bake porcelain-like finish. Hilo Varnish Corp., 42 Stewart Ave., Brooklyn, N. Y.

Cements. Revised and enlarged edition of the Smooth-On Handbook, describing all Smooth-On metal cements and products, illustrating their application by working diagrams, etc. Smooth-On Manufacturing Co., 568 Communipaw Ave., Jersey City, N. J.

Brazing Alloy. Bulletin No. 11. Easy-Flo No. 3, described as a low temperature brazing alloy having a medium silver content. Handy & Harman, 82 Fulton St., N. Y. City.

Modern Industrial Shops. Booklet No. 88, showing a few of the many modern industrial shops equipped with *South Bend Lathes.* Some of the pictures show manufacturing departments in which both pre-

vision, accuracy and top speed production are demanded; others show lathes in tool rooms, etc. South Bend Lathe Works, 555 Niles Ave., South Bend, Ind.

What the Reader Says

Editor, METAL INDUSTRY:

A. D. Gaskin of Bruce Products Corporation, who wrote about iron interference in the thiosulphate method for copper analysis in the December issue, could more easily get around the interference if he added 1 gram of sodium fluoride to the hot solution after the acetic acid had been added. The first end-point that lasts ½ minute is the one to take.

Very truly yours,

Byron Abedon.

Providence, R. I.

New Books

Grinding Wheels and Their Uses, by Johnson Heywood. Published by Penton Publishing Company. Size 9" x 6", 367 pages. Price $3.00.

This book will be found enlightening to those seeking the latest information on modern grinding practice. Shop executives can turn to it for help on everyday grinding problems; grinding machine operators, or those who aim to take up this line of work, can derive much benefit from the information presented; and students in technical and trade schools and colleges can profit from the operating experience of engineers, designers, foremen and employees engaged in the grinding industry.

In 23 chapters covering 367 pages the author has presented a large amount of information to which many hundred men have contributed their practical and theoretical knowledge as well as descriptions of various grinding practices and methods they have found highly satisfactory.

Internal, cylindrical, surface, roll and cam, eccentric and other out-of-round surface grinding are treated in separate chapters. The author discusses the materials used for polishing and buffing and explains how to set up polishing wheels. Throughout the book he stresses ways in which grinding output can be stepped up and the required finish imparted at the lowest overall cost. Many production-speeding and cost-cutting methods and knacks are described. Figures are cited to prove how much the use of better methods has increased production and reduced costs.

Wheel recommendations for various types of grinding are presented in tabular form and include the kind of abrasive, grain, grade and bond for the particular material and job. The text is supplemented with data on the care and safe use of grinding wheels, wheel breakage and safety, and a glossary of trade names.

FARREL NI-HARD

The Roll for High Finish Sheets

Present-day demand for highly finished rolled strip and sheet, with competitive conditions compelling heavier passes to reduce rolling costs, requires rolls which combine extreme hardness with high strength and flawless surface.

Farrel Ni-Hard Rolls have been developed to meet these conditions. They have a hardness of 80 to 90 scleroscope and are completely free from pinholes or "orange-peel" surface; they therefore produce sheets with a higher quality finish and greater uniformity of finish than can be obtained with chilled or other types of alloy rolls.

Their high strength and hardness offer protection against both breakage and deterioration of roll surfaces and permit heavier passes. Less scouring and grinding than any other type of cast roll, and a longer useful life, provide a definite economy both in maintenance and roll cost per unit of output.

Details of application to individual conditions and probable performance will be furnished on request.

Farrel-Birmingham Rolling Mill Equipment includes: Rolls — Rolling Mills — Rod Mill Tables and Manipulating Equipment — Universal Mill Spindles — Rod Coilers — Lead Presses for Pipe or Rod — Roll Grinding Machines — Roll Calipers — Gears — Mill Pinions — Pinion Stands — Drives up to 10,000 H.P. — Flexible Couplings.

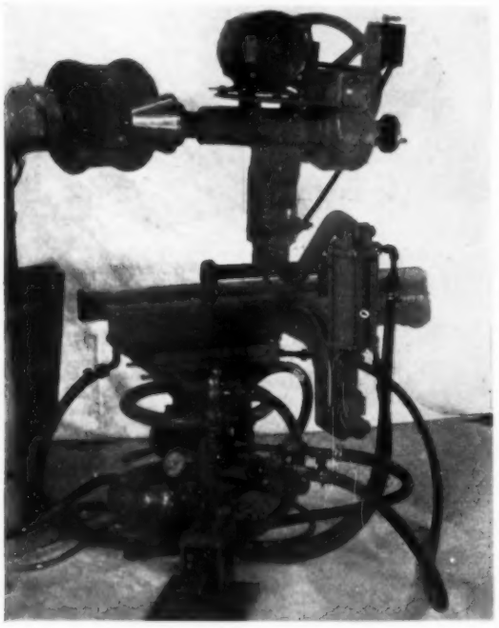
FARREL-BIRMINGHAM
Company, Inc.
201 Main St., Ansonia, Conn.

Journal of the Institute of Metals. Edited by S. C. Guillan. Volume LXII, 1938. Demy 8vo. Pp. 334, with 38 plates and numerous illustrations in the text. London: The Institute of Metals, 4 Grosvenor Gardens, S.W.1. Price 31s.6d.

This volume of the Journal of the Institute of Metals well maintains the standard set by its predecessors. In addition to the stimulating Presidential Address by Dr. C. H. Desch, F. R. S., entitled "A Chemist's View of Metallurgy", the book contains twelve original papers, with discussions, on questions of great theoretical and practical importance in the field of non-ferrous metallurgy. These papers deal with such diverse subjects as the age-hardening of aluminium alloys, the crystallization of copper the physical and mechanical properties of nickel-brasses, magnesium alloys, rolled molybdenum sheet, the creep of tin and its alloys, porosity in hot-tinned coatings on copper, and soft-soldered joints. Powder metallurgy, which is becoming of such increasing importance, is represented by a contribution from the General Electric Co. Ltd., on copper-nickel-tungsten alloys sintered with a liquid phase present. The volume concludes with Professor G. I. Taylor's May Lecture on "Plastic Strain in Metals", in which the author describes his work with Dr. C. F. Elam on the straining of

REVOLUTIONARY

Style D-A Workholder, showing smoker bowl in place which is of the "hollow vessel" type.



WHICH IS MORE ECONOMICAL?

Special polishing machinery, which is applicable to only one type of work

OR

Howell Production Machinery, for less money, which employs four distinct set-ups to finish any of the following sizes or shapes:

1. Hollow vessels
2. Circular or symmetrical pieces
3. Irregular, small parts
4. Tubing—straight and tapered

By means of a foot pedal, constant pressure of the work is maintained against the polishing wheel—a factor which is not found in other methods due to the wear of the polishing wheel. Also, a multiple chuck is used, making it possible for the operator to remove and replace finished work without interrupting the polishing operation.

Many other new and unusual features mark the Howell Method as distinctive — "REVOLUTIONARY."

Increase your production; reduce labor costs! Submit samples for analysis. No matter what size or shape your work may be, without delay and without obligation on your part, we will present production figures.

Designers and Manufacturers of Special Machinery

HOWELL ENGINEERING COMPANY

DIVISION OF THE HOWELL CO.

ST. CHARLES, ILLINOIS

metallic single crystals, and discusses the application of experimental results with single crystals to polycrystalline aggregates.

Like the previous volumes, the book is excellently produced, well bound, the diagrams are clear, and the photographs are printed on excellent quality paper. This *Journal* is one which should be on the shelves of every non-ferrous metallurgist.

Pattern Making, by James Ritchey. Revised by Walter W. Monroe, Charles W. Beese and Philip R. Hall. Published by American Technical Society, Chicago, Ill. Size 8½" x 5½"; 230 pages. Price $2.00.

A practical treatise for the pattern maker on woodworking and wood turning, tools and equipment, construction of simple and complicated patterns, modern molding machines and molding practice.

The book is very practical and easily read, and well illustrated with 350 illustrations. This book should be obtained by those interested in pattern making or actually engaged in the making of patterns.

Foundry Work, by William C. Stimpson and Burton L. Gray, revised by John Grennan. Published by American Technical Society, Chicago, Ill. Size 8½" x 5½"; 214 pages. Price $2.00.

A practical handbook on standard foundry practice, including hand and machine molding with typical problems, casting operations, melting and pouring equipment, metallurgy of cost metals, etc.

Journal of the Electrodepositors' Technical Society. Volume XIV. 1937-1938. Editorial Board: C. F. Francis-Carter, G. E. Gardam, A. W. Hothersall, J. W. Perring and S. Wernick. Published by the Electrodepositors' Technical Society, Northampton Polytechnic Institute, St. John St., Clerkenwell, London, E.C.1. Size 9" by 6"; 248 pages. Price, to members 15d; to non-members 1 guinea.

This volume is in keeping with its very excellent predecessors, being well edited and with particularly fine illustrations.

The book includes papers on electrodeposition presented at the various meetings of the Electrodepositors' Technical Society during 1937 and 1938.

Aluminum Bronze. Published by Copper Development Association, Thames House, Millbank, London, S.W.1, England. Size 8¾" x 6¼"; 147 pages. No charge is made for the publication, but it will be possible to supply copies only to those making application on the firm's letter-head or otherwise giving satisfactory evidence of responsible status or genuine interest.

This book is concerned with the copper-aluminum series of alloys containing copper as the major constituent. Some of the subject matter includes general properties of aluminum-bronze, the cold and hot working of alloys, casting of aluminum-bronzes as well as their production and fabrication. The book is very well printed and illustrated on excellent paper and contains a bibliography of 211 literature references.

Mechanical World Year Book. 1939. Published by Emmott & Co. Ltd., Manchester, England. Size 6" x 4"; 360 pages. Price 1/6 net.

This is the 52nd year of publication of this valuable little handbook which has undergone general detailed revision and concise tabular information has been included on the properties of metals and alloys.

Associations and Societies

American Electro-Platers' Society

Baltimore-Washington Branch

The Annual Educational Session will be held Saturday, February 4, 1939 at 2:30 P.M. in Room 100, Electrical Engineering Building, University of Maryland, College Park, Md. (10 miles northeast of Washington). The following speakers will take part:—

H. Leroy Beaver, Abbott Ball Co.
"Barrel Finishing of Metal Products."

Edwin C. Rinker, Oakite Products Co.
"Plating of Jewelry Novelties."

F. Fulforth, Proctor Electric Co.
"Constructive Pre-plating Methods."

R. H. Kittner, American Hard Rubber Co.
"Applications of Rubber in Plating."

W. M. Phillips, General Motors Corporation
"The Story of a Grill."

The dinner will be held at 7:00 P.M. at the Lord Calvert Inn, on the Washington Boulevard at College Park. Tickets $2.00.

Detroit Branch

The second Annual Educational Session and Banquet of the Detroit Branch, held on Saturday, December 10th, was a decided success with 547 people in attendance at the Banquet.

The speakers were *Dr. O. P. Watts*, Professor Emeritus of the University of Wisconsin, who spoke on "Corrosion" and *Dr. Walter R. Meyer*, Editor, METAL INDUSTRY, who spoke on "Metallic Impurities in Plating Solutions".

An excellent movie on materials, supplied by the General Motors Corporation, completed the program.

The committee was as follows:

Chairman: *H. M. Cherry*, Hanson-Van Winkle-Munning Company.

Entertainment: *George L. Nankervis*, Frederic B. Stevens, Inc.

Educational Program: *Charles Eldridge*, United Chromium, Inc.; *R. B. Saltonstall*, The Udylite Company; *R. L. Redmond*, Automotive Rubber Products Company.

Tickets: *Charles Beaubien*, J. B. Ford Company; *Wright Wilson*, Chrysler Corporation.

General Committee: *Austin Wilson*, Chevrolet Gear and Axle Plant, General Motors Corp.; *Carl Huessner*, Chrysler Corporation; *Wm. McCord*, McCord Radiator & Manufacturing Company; *Charles Anger*, The Udylite Company; *H. W. Kennedy*, E. I. duPont de Nemours & Company; *J. Higgins*, Packard Motor Car Company, Secretary-Treasurer, *T. C. Eichstaedt*, J. C. Robinson Company.

Chicago Branch

The Chicago Branch will hold its Annual Educational Session and Banquet on Saturday, January 28, 1939, at The Palmer House in Chicago, Ill. There will be a very interesting educational session at 2 P. M. with prominent men such as President, *W. M. Phillips*, *Floyd Oplinger*, *G. A. Stocker* and *Walter Pinner* as speakers. The Banquet will start at 7:00 P. M. with an evening of high class entertainment and dancing.

New York Branch

Lionel Cinamon will address the New York Branch on Friday evening, January 13th, at the Hotel Pennsylvania on "Some Reflectivity Relationships of Individual Metals to Electroplated Alloys".

A joint educational session, banquet and dance, with the Newark Branch will be held on Saturday afternoon and evening, February 18th.

The meetings will be held in the Salle Moderne and Roof Garden of the Hotel Pennsylvania, New York City.

For further information write to *F. J. MacStoker*, Secretary, 25 Princeton St., Garden City, N. Y.

Boston Branch

The Boston Branch will hold its 5th Annual Educational Session and Banquet at the Hotel Bradford, Boston, Mass., on Saturday, March 4.

W. C. Treadwell is chairman.

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Newark Branch

Fred Fulforth, vice-president American Electro-Platers' Society addressed the Newark Branch on Friday evening, December 16th on "Constructive Pre-Plating Methods".

The meeting was well attended and after the talk an informal Christmas party was held at the Elks' Club.

The First meeting of the Ladies Committee for the 1939 International Convention was held on Monday, Sept 26/38 at the Trustees Room of the Newark Elks Club. *Mr. Horace H. Smith*, General Chairman of the Convention, opened the meeting and appointed as officers, *Mrs. Horace Smith*, Chairlady; *Mrs. George Wagner*, Sec'y; *Mrs. Nelson Sievering*, Treasurer. Mr. Smith instructed the officers as to their duties and then turned the meeting over to them. Following are the names of the ladies who answered the call to act on the committee and have been active ever since; *Mrs. Roy Stout—Mrs. Gorge Reuter—Mrs. Daniel Davies—Mrs. Paul Oldam—Mrs. Oliver Sizelove—Mrs. Paul Santella—Mrs. John Kotches—Mrs. William Hodecker, Sr.—Mrs. George Klink—Mrs. John Shuhala—Mrs. John Holland—Miss Cecile Tomarazo.* They are holding meetings every other Monday.

The Second meeting was held on October 10th at the home of *Mrs. George Klink*. After a short business meeting a Card and Prize party followed. 15 committee members and 18 visitors were present.

The Third meeting was held on October 24th at the home of *Mrs. Horace Smith*, where a short business meeting was conducted which was followed by a Prize party.

The Fourth meeting was held at the home of *Mrs. William Hodecker, Sr.* on November 7th. The business meeting was omitted and the evening was devoted to Card and Prize games. 14 committee members and 19 visitors attended.

The Fifth meeting was held on November

21st at the home of *Mrs. George Wagner*. The meeting was called to order by Chairlady Mrs. Horace Smith, at 9 P. M. The whole evening was devoted to business. The report was made by one of the committee members that the total proceeds made at the Prize party on the 15th of November at the Mosque Ballroom were being turned over to the Ladies Committee so that they may have a good start towards their contemplated amount for the Convention.

The Ladies Committee expects to entertain all the ladies who attend the convention, out of the funds raised at these various meetings.

Electrochemical Society

Metropolitan Section

Raymond R. Rogers, *Secretary-Treasurer*
Columbia University, New York City

A meeting of the Metropolitan Section of the Electrochemical Society will be held in Room 309, Havemeyer Hall, Columbia University (117th St. & Broadway) on Friday, January 27 at 7.45 P. M. Non-members are cordially invited.

Subject: "Electric Furnaces".

Speaker: Mr. Robert L. Baldwin, President of the Electrochemical Society.

Mr. Baldwin has had many years of close association with the electric furnace and electrode industries. At present, he is Sales Development Manager of the Electrode Division of the National Carbon Co. In addition to a discussion of electric furnaces in general, Mr. Baldwin will tell of his experiences in electrode sales development work.

The first meeting of the season was held on November 18 at Columbia University. Approximately one hundred were in attendance.

Dr. W. R. Meyer, editor of METAL INDUSTRY, spoke on "Solving Metal Coating Problems with the Aid of the Microscope." The address was illustrated by more than thirty photomicrographs. At the conclusion of the address, Dr. W. A. Wesley of the International Nickel Company led an interesting discussion.

Chicago Section

L. G. Van de Bogart, *Secretary*
Crane Co., Chicago, Ill.

The third meeting of the current season was held at the Electric Club on Friday evening, December 2, 1938. Speakers for the evening were *Dudley Willcox* and *Mr. Meyer* of the Ajax Electrothermic Corporation. They presented newest developments in high frequency melting furnaces, high frequency heating, forging, and hardening equipment, and other miscellaneous high frequency furnace applications. Slides showing the various sizes and arrangements of melting furnaces for steel, brass and aluminum, as well as heating, forging and hardening applications were shown. A short film was also shown. The talk was followed by a period of animated discussion.

Cleveland Section

Carl E. Heil, *Secretary-Treasurer*
Heil & Company, Cleveland, Ohio

The regular monthly meeting was held on November 8th at the Bolton Square Hotel, *R. S. Mackie*, Chairman, presiding. Approximately eighty members and guests were in attendance.

The guest speaker of the evening was *Dr. Alexander Lowy*, of the University of Pittsburgh, who presented as his subject "The Progress in the Electrochemistry of Organic Compounds." The talk was illustrated with blackboard sketches and lantern slides. A great deal of interest developed during the discussion following the talk.

Philadelphia Section

Harold J. Reed, *Secretary*
Harrison Lab. of Chemistry, Philadelphia, Pa.

A meeting of the section was held on December 8, at the John Harrison Laboratory of Chemistry, University of Pennsylvania. *Dr. H. Jermain Creighton* of Swarthmore College spoke on the topic, "Electrolytic Reduction of Sugars." The talk was followed by discussion by the members and guests in attendance.

American Welding Society

The 5th Evening Lecture Course of the American Welding Society will be held January 17th, at the Polytechnic Institute of Brooklyn, N. Y., with *C. W. Obert*, Engineering Department, Linde Air Products Company, presiding. *W. D. Halsey*, assistant chief engineer, Boiler Division, The Hartford Steam Boiler Inspection and Insurance Company, will lecture on "Qualification Inspection".

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CHICAGO

Obituaries

Frederick J. Lorch

Frederick J. Lorch died December 6th in New Britain, Conn.

Mr. Lorch was born on June 1st, 1883. After leaving school he entered the employ of P. & F. Corbin Division of American Hardware Corporation, where he learned plating and metal finishing under the supervision of his father, and remained with them excepting for a few years spent in Southern California. Upon his return about twelve years ago, he re-entered the employ of the P. & F. Corbin Division, and since the retirement of his father about nine years ago had been in charge of the Special Finishes Department.

Mr. Lorch is survived by four sisters and two brothers.

Warren A. Guy

Warren A. Guy, a well known figure in the plating industry for over forty years, died on November 20, in Buffalo, N. Y.

Mr. Guy was born in Binghamton, N. Y., in 1877, and in 1912 he opened the Salt City Plating Works, Syracuse, N. Y., which he ran successfully for eight years. He next became plating foreman of Penn Spring Works, Baldwinsville, N. Y., for five years and later held the same position with the Brewer Titchener Company of Cortland, N. Y., for three years.

At the time of his death Mr. Guy was department head of the plating department of Trico Products Corporation, Buffalo, N. Y., having acted in this capacity for the past ten years, supervising both polishing and plating. He was one of the main figures in organizing the Buffalo Branch of the A.E.S., and was also a member of the Rochester Branch.

His keen sense of humor and his thorough knowledge of plating in general won for him the friendship and respect of all with whom he came in contact, and he was always willing to further the interests of his younger associates.

Mr. Guy is survived by his wife and family of six.

Dr. Alcan Hirsch

Dr. Alcan Hirsch, chemical engineer who was consultant in chemical industries for several governments, died November 24th at New Rochelle Hospital, New Rochelle, N. Y.

Dr. Hirsch, who was fifty-three years old, suffered a heart attack while horseback riding two weeks previous and had been in the hospital since that time.

Dr. Hirsch was born at Corpus Christi, Tex., a son of David and Olivia Benedict Hirsch, and was graduated in 1907 from the University of Texas. He received the degrees of Master of Science, Chemical Engineer and Doctor of Philosophy from the University of Wisconsin, and for a time was a research associate in Chemical Engineering at Massachusetts Institute of Technology.

In 1911 he opened a laboratory in New York City, serving as consultant to corporations. He was consultant in chemical development to the Japanese government from 1916 to 1918.

Dr. Hirsch formed the Rector Chemical Corporation in 1917 and in 1920 was a founder of the Molybdenum Corporation of America. In 1918-1920 he was consultant to the Bayer Company, manufacturers of Bayer's aspirin. He was formerly chemical director of the J. D. Devine Company of Buffalo and the Treadwell Engineering Company of New York.

Dr. Hirsch received the Carnegie Award of the Iron and Steel Institute of Great Britain and was a member of the American Chemical Society, the American Institute of Chemical Engineers, the American Electrochemical Society and other scientific organizations. He also was a member of the Phi Beta Kappa, honorary scholastic society and of Sigma Xi.

At his death he was vice-president of Hiresta Laboratories in New York City and the Hirsch Laboratories.

Charles H. Scheerbaum

Charles H. Scheerbaum, purchasing agent of the Abrasive Co., Philadelphia, and a well-known figure in the industrial supply field died recently at his home. His passing will be deeply felt by his many friends and associates.

William D. Lewis

William D. Lewis, 78, retired director and purchasing agent of the Cleveland Hardware Company, Cleveland, Ohio, died at Lake Worth, Fla., Nov. 3rd at the age of 78. He had been with the company forty-nine years.

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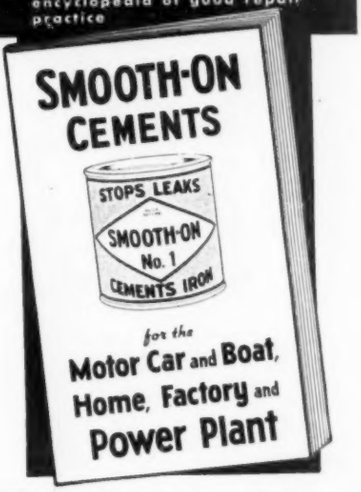

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HARRISON & COMPANY HAVERHILL, MASS.

Frank G. Hogland

Frank G. Hogland, president and co-founder of the National Lock Company, Rockford, Ill., died recently at the Swedish-American Hospital after a short illness. He was 74 years old.

Surviving are a daughter, Mrs. H. M. Wortham of Rockford and a sister, Augusta M. Hogland of Chicago.

Percy C. Day, vice-president and chief engineer of the Falk Corp., Milwaukee, died Dec. 7 at his home in Elm Grove, Wis. He was 63 years old.

Victor R. Baur, an official of the National Lead Co., was buried Dec. 7 at Detroit.

William J. Chalmers, former chairman of the Allis-Chalmers Mfg. Co., Milwaukee, died recently at his home in Chicago. He was 86 years of age. Born in Chicago in 1852, Mr. Chalmers studied machinery with his father, both in this country and abroad. In 1872 he helped form the original partnership of Frazer, Chalmers & Co., which, after several years of expansion, consolidated in 1891 with the E. P. Allis Co. as the Allis-Chalmers Mfg. Co. Mr. Chalmers headed this organization until 1906, when he retired.

John H. Knapp, vice-president and general manager of the Norge Div., Borg-Warner Corp., died recently at his home in Detroit. He was 44 years of age.

Personals

Harry C. Bernard

Harry C. Bernard, who is well known in the plating industry, recently resigned his position as Sales Manager of the Magnuson Products Corporation.

He has since that time become associated with the Zophar Mills, Inc., 116—26th Street, Brooklyn, New York, which will place on the market a complete line of industrial cleaning compounds.

H. C. BERNARD

Harry Bernard was originally a plater, and as such was very active in organizing educational work. He was a charter member of the National Electro-Platers' Society, predecessor of the present American Electro-Platers' Society. In 1920 he acted as program and publicity manager for the convention of the American Electro-Platers' Society, held in Rochester, N. Y. He was an early vice-president of the New York Branch, A. E. S. At that time he was plating and finishing superintendent for the Elite Novelty Company, Newark, N. J. He had previously been in a similar position with the Bommer Spring Hinge Company, Brooklyn, New York, and with Sargent and Company, New Haven, Conn.

Ending his association with the Elite Novelty Company in 1917, he was with Oakite Products, Inc. for 15 years before accepting the position which he has recently resigned.

C. J. Brockman, associate professor of chemistry at the University of Georgia, has been elected vice-chairman of the Georgia State Board of Registration for Professional Engineers and Surveyors.

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Harrison, Ohio

Bernard C. Case has joined the staff of the Hanson-Van Winkle-Munning Company, manufacturers of electroplating equipment and supplies, Matawan, New Jersey. Mr. Case, who will devote himself to special sales work for the company, graduated from the University of Michigan in 1928. He has been engaged in chemical work, first for the Eaton Manufacturing Company, Cleveland, Ohio and later for the Bridgeport Brass Company, Bridgeport, Conn., where

BERNARD C. CASE

he was in charge of plating. Mr. Case has done original research in electroplating and has taken out a patent (assigned to the Eaton Manufacturing Company) on an anode for the control of pitting in nickel solutions.

Dr. Edward R. Weidlein, Director, Mellon Institute, Pittsburgh, has announced the establishment of an Industrial Fellowship in that institution by the American Air Filter Company, Inc., of Louisville, Ky. This Fellowship will investigate broadly materials of value in the construction of filters for air-conditioning systems. It will be the aim to gain through this research new knowledge to effect all possible improvements in the devices manufactured by the donor, and in this work the Fellowship will have the direct cooperation of specialists on the staff of the Multiple Industrial Fellowship on air hygiene in operation in the Institute.

Dr. Frank F. Rupert, who has been appointed to the incumbency of the Fellowship, has been a member of Mellon Institute since 1913. He received his professional education at the University of Kansas (A.B., 1906; A.M., 1908) and at the Massachusetts Institute of Technology (PhD., 1912). He served as instructor in chemistry at the University of Kansas previous to 1912 and during the period 1912-1913 was junior physical chemist in the U. S. Bureau of Mines. Since 1935 Dr. Rupert has been associated with the Fellowship on air hygiene in Mellon Institute.

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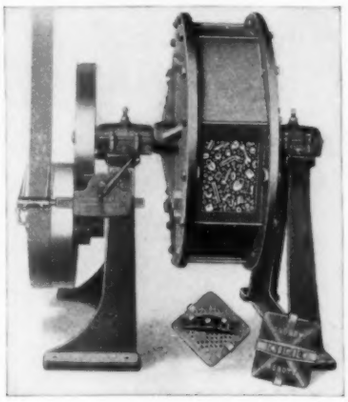

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LACQUERS, ENAMELS AND SYNTHETICS
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S. M. Hendrickson for many years engaged in the metal cleaning field has recently become associated with Zophar Mills, Inc., Brooklyn, New York.

C. L. Van Derau, Manager of Manufacturing at Westinghouse Electric & Manufacturing Company, Mansfield, Ohio, and past president of the American Electro-Platers' Society, was elected president of the Mansfield Chamber of Commerce at its annual reorganization meeting on Tuesday, November 29th.

Mr. Van Derau succeeds Common Pleas Judge, C. H. Houston.

Dr. Maurice Huisman and *Mrs. Huisman* have returned to Belgium after having spent a year in this country on the study of electroplating. During a part of this time, Dr. Huisman was on the fellowship of the Belgium American Educational Foundation. He visited a large number of electroplating plants and research laboratories in this country. In addition he spent considerable time

Left to right Dr. Huisman, Mrs. Huisman, Dr. W. Blum

at the National Bureau of Standards where he assisted in various electroplating studies. Dr. Huisman expects to engage in some activities in electrodeposition on his return to Belgium although his exact plans are not yet certain.

Dr. Waldemar Theodore Schaller, chief mineralogist of the United States Geological Survey and world authority on rare and unusual minerals, has been awarded the Roebling Medal by the Mineralogical Society of America "for meritorious achievement in mineralogy and allied sciences," it is announced by *Dr. Ellis Thomson*, president of the Society.

Charles C. Arnold, Jr., recently resigned his position as Chief Chemist (Industrial Finishes Division) of the Zapon Division of the Atlas Powder Company to accept a position as Research Chemist with The Lilly Company, High Point, North Carolina.

Mr. Arnold was graduated from Middlebury College with honors in chemistry in 1928. After a year of graduate study at the University of Oklahoma, he joined the research staff of the Shell Petroleum Corporation at their Sellers, Louisiana refinery. He resigned this position early in 1930 to become associated with the Zapon Division of the Atlas Powder Company, and was promoted to the position of Chief Chemist in 1935.

Verified Business Items

The Lea Manufacturing Company, Waterbury, Conn., has recently become a distributor for the American Cyanamid and Chemical Corporation in the sale of industrial cyanides for use in the electroplating industry.

Great Lakes Supply Corp., Chicago, Ill., has announced its appointment as a distributor of the Norton Company's line of abrasives, which includes grinding wheels, bricks and sticks. Sales and service of these products will be cared for by *Frank S. Baldwin*.

Connell Wood & Metal Patterns, Inc., 4238 Park Ave., Bronx, N. Y., has leased about 10,000 sq. ft. of floor space in building at 4077 Park Avenue for plant, removing present works to new location and increasing capacity. The firm specializes in wood and metal patterns for quantity production. Principal base metals used: brass, bronze and aluminum.

Kuhlman Electric Co., has purchased the Detroit Electric Furnace business and will operate it as the Detroit Electric Furnace Division of Kuhlman Electric Company. The same sales, service and production personnel which have been with the company for many years will continue in the conduct of the company's business under the direction of *A. E. Rhoads*. The company's offices, machine shop, experimental equipment and parts stock have been transferred to Bay City, Mich.

Spencer Lens Co., Buffalo, N. Y., will double its production capacity on completion of a new mechanical production unit under construction since October 8th. The new unit will combine most modern features proved suitable for a plant to house machinery devoted to precision manufacturing of light mechanical parts which demand extreme accuracy. The Spencer Lens Company is the scientific instrument division of the American Optical Company, Southbridge, Mass. Spencer manufactures microscopes and scientific instruments for scientific laboratory use.

J. Holland & Sons, Inc., polishing and electroplating supplies and equipment, are now located in their new building at 274 S. 9th Street, Brooklyn, N. Y.

Alexander Milburn Company, 1416 W. Baltimore St., Baltimore, Md., announces the appointment of *Frank P. Snyder*, formerly sales engineer for the DeVilbiss Company, as sales representative in Detroit, Mich.

Wollen Chemical and Supply Company, has purchased the building previously occupied by Grasselli Div. of E. I. duPont de Nemours & Company, at Waite Street and Sixth Avenue, Paterson, N. J.

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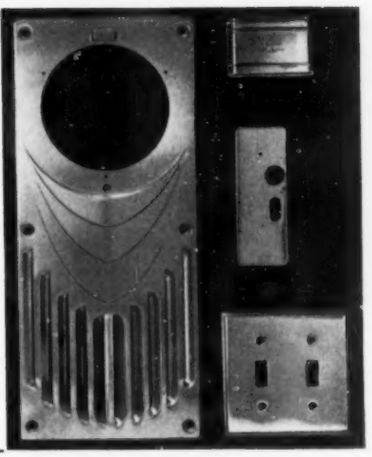
We've been preaching this bit of wisdom for many a year. After trying SPEEDIE BUFFING & POLISHING COMPOSITIONS, we're sure you'll agree that they're a great deal cheaper in the long run.

Write today for *interesting* prices and samples, advising type of work to be buffed.

THE BUCKEYE PRODUCTS CO.
Cincinnati, Ohio

TRIPOLI — LIME FINISH

Save on Stampings
WITH
AMERICAN BONDED METALS



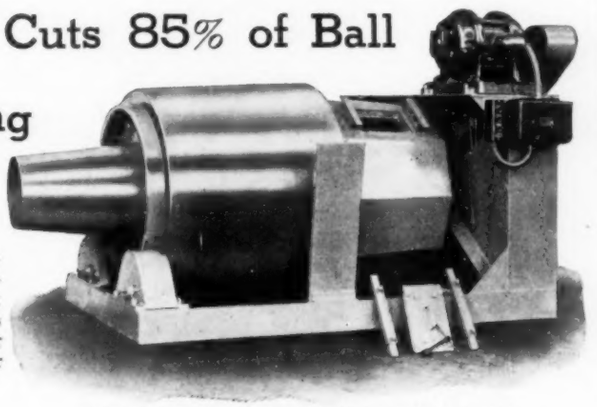
No plating or polishing required! These metals are *pre-finished*—in most any finish or pattern you want. Fewer rejects—the *uniform* finishes are guaranteed not to chip or peel. If you want new speed and economy in producing practically any type of stamped, formed, drawn or etched part, write on your company letterhead for a free booklet giving complete details about these money-saving metals.

AMERICAN NICKELOID COMPANY
8 Second Street, Peru, Illinois
Sales Offices in All Principal Cities

IDEAL
TRADE MARK REG. U.S. PAT. OFF.

Cuts 85% of Ball Burnishing Labor Cost

This barrel accommodates more burnishing material, handles it automatically, produces better finish, larger production, at lower cost.



Side-loading, end-discharge IDEAL Burnishing Barrel

Put it up to Specialists

N. Ransohoff Inc.
West 71st St. at Millcreek, Carthage, Cincinnati, O.

We also manufacture drying, sawdust tumbling, plating, separating and pickling machinery.

The Institute of Electrochemistry and Metallurgy, 59-61 East Fourth Street, New York City, which was organized in September 1938 for the purpose of disseminating knowledge in the field of electroplating and metallurgy, has been approved by the New York State Department of Education.

For the first semester, thirty-two men have registered for the various courses offered by the Institute. In fact, the number taking the courses proved to be larger than that expected by the officers of the school and more space had to be secured.

All classes are given by *Dr. C. B. F. Young* who is assisted by *Walter Klinsevich* and *Louis Sherman*. Mr. Klinsevich received his B. S. degree from Columbia University while Mr. Sherman received the same degree from Cooper Union.

During the second semester, three courses will be offered to the men of the industry. These are:

Electroplating I—This course is designed to give the electroplater a systematic study of the ways and means of obtaining better deposits by applying the latest scientific methods of electrochemistry to electroplating. One hour of each evening is devoted

Classroom instruction

to a lecture by the instructor on the fundamentals of electrometallurgy and the remaining three hours are devoted to the application of these laws by the student in the laboratory. Copper, nickel, zinc, cadmium, chromium, silver, and brass are deposited from aqueous solutions. While plating the above-named metals, the factors governing the character of the deposits are noted by the student. Also, aluminum is anodized and colored, the thickness of metallic deposits are determined and brighteners are studied. After completing the above-mentioned experiments, the students now make up standard reagents and analyze all the baths for their constituents.

Metallurgy II—This course consists of one lecture each week on physical metallurgy. The rest of the time is spent in the laboratory where the student polishes, etches

Metallurgical laboratory

and examines specimens under the microscope. Approximately ten different metals and alloys are observed by the student.

Research II—This course is designed to give the practical electrochemist a chance to investigate certain problems which are related to his field of work. One half hour of each week is devoted to a conference with the instructor. The remaining time is spent in the laboratory where the student solves the problems arising in such an investigation.

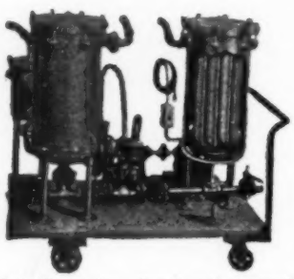
The registration dates for all courses are February 1 to February 8. All courses are taught on Tuesday and Wednesday, 7-11 P. M. Further information may be obtained by writing to the Institute at the above address or calling Orchard 4-1778.

Bethlehem Steel Company, Bethlehem, Pa., has taken out a license to make leaded steels under Inland patents.

Bridgeport Brass Company representatives from 21 branch offices throughout the United States will be called to Bridgeport on January 9th for the first national convention to be held by the company in its 73rd year history, according to an announcement by *Herman W. Steinkraus*, vice-president in charge of sales of the company. Departing from the regular practice followed in past years of holding sectional conferences, the company is calling all of its representatives together in a national convention so that they may have the opportunity to visit and get first-hand information about the new and improved manufacturing plants.

FILTERS FOR ELECTROPLATING SOLUTIONS

AVAILABLE IN FIFTEEN TYPES AND SIZES



Cut illustrates closed and internal view of filter.

CAPACITIES: 200 to 2400 gallons per hour.

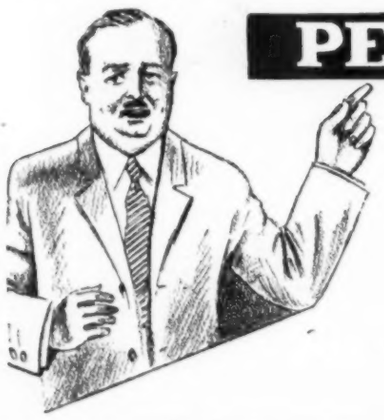
A TYPE AND SIZE FOR YOUR EXACT REQUIREMENT.

WRITE for our NEW BULLETIN giving complete specifications, recommendations, and prices on FILTERS for NICKEL or BRIGHT NICKEL, ROCHELLE COPPER, STANNATE TIN, DUPONT COPPER, BRITE ZINC, CADMIUM, CYANIDE BRASS, COPPER, SILVER, ETC.

Also ask for information on filters and chemicals for clarifying various solvents used in degreasing units, oleum spirits, naptha, etc.

INDUSTRIAL FILTER & PUMP MFG. CO.

3017 W. Carroll Ave. **Chicago, Ill.**



PERMAG Cleaning Compounds

—point the way to more Profits in 1939

Metal cleaning costs are cut by using PERMAG. Labor is saved; better work is accomplished and overhead reduced. If you have a metal cleaning problem that baffles everyone let the Magnuson Research Service take it over—that's our job! Write or 'phone us.

MAGNUSON PRODUCTS CORPORATION

Main Office and Factory, Third & Hoyt Sts., Brooklyn, N. Y.

28 years' experience manufacturing, selling and servicing Specialized Industrial Cleaning Compounds for every purpose.
Representatives, also Warehouses in Principal Cities of U. S. from Coast to Coast
Canadian Branch: Canadian Permag Products Ltd., Ottawa & Queen Sts. Montreal, P. Q. **Cable Address PERMAG, N. Y.**

Metal Prices, January 4, 1939

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

New Metals

COPPER: Lake, 11.375, Electrolytic, 11.25, Casting, 10.225.
ZINC: Prime Western, 4.50. Brass Special, 4.60.
TIN: Straits, 46.50. LEAD: 4.70.
ALUMINUM: 20. ANTIMONY, Ch. 14.00.
NICKEL: Shot, 36. Elec., 35.

QUICKSILVER: Flasks, 75 lbs., $77.00. BISMUTH, $1.05.
CADMIUM, .60. SILVER, Troy oz., official pr., N. Y., Jan. 4, 42¾c.
GOLD: Oz. Troy, Official U. S. Treasury price $35.00.
SCRAP GOLD, 6¾c. per pennyweight per karat, dealers' quotation.
PLATINUM, oz. Troy $34.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Ingot Metals and Alloys

	Cents lb.	Duty	U. S. Import Tax*
No. 1 Yellow Brass	8.875	None	4c. lb.[1]
85-5-5-5	11.00	None	4c. lb.[1]
88-10-2	14.50	None	4c. lb.[1]
80-10-10	12.875	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	10.875	None	4c. lb.[1]
Aluminum Bronze	15.125	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	12.875	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	15.125	20% a. v.	4c. lb.[1]
No. 12 Aluminum	13.50-15.25	4c. lb.	None
Manganese Copper, Grade A (30%)	22-27	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	15.00	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	15.50	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	21.50	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	50-60	None	None
Iridium Platinum, 5% (Nominal)	$35.25	None	None
Iridium Platinum, 10% (Nominal)	$36.50	None	None

* Duty is under U. S. Tariff Act of 1930; tax under Section 80 (7) of Revenue Act of 1932.
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

Old Metals

Dealers' buying prices, wholesale quantities:

	Cents. lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	7⅛ to 7¼	Free	4c. per pound on copper content
Light copper	6¾ to 6⅞	Free	
Heavy yellow brass	4½ to 4⅝	Free	
Light brass	3¾ to 3⅞	Free	
No. 1 composition	7 to 7⅛	Free	
Composition turnings	6⅝ to 6¾	Free	
Heavy soft lead	3¾ to 4	2⅛c. lb.	
Old zinc	2¼ to 2½	1½c. lb.	
New zinc clips	2¾ to 3	1½c. lb.	
Aluminum clips (new, soft)	13 to 13¼	4c. lb.	
Scrap aluminum, cast	7¾	4c. lb.	
Aluminum borings—turnings	4 to 4¼	4c. lb.	None
No. 1 pewter	25 to 26	Free	
Electrotype	4¼ to 4⅜	2⅛c. lb.*	
Nickel anodes	27 to 28	10%	
Nickel clips, new	28 to 29	10%	
Monel scrap	8 to 15	10% av.	

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' lists, effective since Dec. 14, 1938. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

Copper Material

	Net base per lb.	Duty*
Sheet, hot rolled	19⅜c.	2½c. lb.
Bare wire, soft, less than carloads	15⅜c.	25% a. v.
Seamless tubing	19⅞c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty under Revenue Act of 1932.

Nickel Silver

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	26 c.	10% Quality	28⅝c.
15% Quality	27⅜c.	15% Quality	31⅞c.
18% Quality	28⅜c.	18% Quality	34¾c.

Brass and Bronze Material

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	U. S. Import Tax
Sheet	17.31c.	18.25c.	19.37c.	4c. lb	4c. lb. on copper content.
Wire	17.56c.	18.50c.	19.62c.	20%[2]	
Rod	12.62c.	18.50c.	19.62c.	4c. lb.	
Angles, channels	25.75c.	26.75c.	27.88c.	12c. lb.	
Seamless tubing	20.06c.	20.90c.	21.77c.	8c. lb.	
Open seam tubing	25.75c.	26.75c.	27.88c.	20% a.v.	

Tobin Bronze and Muntz Metal

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	19⅛c.
Muntz or Yellow Rectangular and other sheathing	20½c.
Muntz or Yellow Metal Rod	16⅝c.

Aluminum Sheet and Coil

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, carload lots, per lb.	33.00c.
Aluminum coils, 24 ga., base price, carload lots, per lb.	28.50c

Rolled Nickel Sheet and Rod

Net Base Prices

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Hot Rolled Rods (base)	35c.	No. 35 Sheets (base)	37c.
Cold Drawn Rods (base)	40c.	Std. Cold Rolled Sheets (base)	39c.

Silver Sheet

Rolled sterling silver (Jan. 4) 45c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

Zinc and Lead Sheet

Cents per lb.

	Net Base	Duty
Zinc sheet, carload lots standard sizes and gauges, at mill, less 7 per cent discount	9.75	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	10.75	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	14.75	2c. lb.
Full Lead Sheet (base price)	7.75	2⅜c. lb.
Cut Lead Sheet (base price)	8.00	2⅜c. lb.

Block Tin, Pewter and Britannia Sheet

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 60.

Supply Prices, January 4, 1939

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast	20⅞c. per lb.	NICKEL: 90-92%, 16″ and over	.45 per lb.
Electrolytic, full size, 15⅞c.; cut to size	15⅞c. per lb.	95-97%, 16″ " "	.46 per lb.
Rolled oval, straight, 16⅜c.; curved	17⅜c. per lb.	99%+cast, 16″ and over, 47c.; rolled, depolarized, 16″ and over, 48c.	
BRASS: Cast	17¾c. per lb.	SILVER: Rolled silver anodes .999 fine were quoted Oct. 31, from 46c. per Troy ounce upward, depending on quantity.	
ZINC: Cast	10 c. per lb.		

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P. l.c.l., drums	lb.	.06¼
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16¾-.17¼
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027
Hydrochloric, C.P., 20°, carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36°, carboys	lb.	.06
Nitric, 42°, carboys	lb.	.075
Oleic (Red Oil), distilled, drums	lb.	.08⅜
Oxalic, bbls. l.c.l.	lb.	.12-.14
Stearic, double pressed, distilled, bags	lb.	.10-.11
single pressed, bags	lb.	.095-.105
triple pressed bags	lb.	.135-.145
Sulphuric, 66°, carboys	lb.	.025
Alcohol, Amyl, l.c.l., drums	lb.	.14
Butyl-normal, l.c.l., drums	lb.	.10
Denatured, S.D. No. 1, 190 pf., bbls., works	gal.	.33
Diacetone, pure, drums, l.c.l.	lb.	.12
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.385
Propyl-Iso, 99%, l.c.l., drums	gal.	.41
Propyl-Normal, drums	gal.	.70
Alum, ammonia, granular, bbls., works	lb.	.032
Potash, granular, bbls., works	lb.	.034-.037
Ammonia, aqua, 26°, drums, carboys	lb.	.025-.05¼
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.05-.075
Sulphate, tech., bbls.	lb.	.035-.05
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	.55-.58
Sulphocyanide (thiocyanate), com'l, drums	lb.	.16
Antimony Chloride (butter of antimony), sol., carboys	lb.	.13-.153
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.029
Benzene (Benzol), pure, drums	gal.	.21
Butyl Lactate, drums	lb.	.225
Cadmium Oxide, l.c.l., bbls	lb.	.85
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05¾-.075
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05¾-.06
Carbon Tetrachloride, l.c.l., drums	lb.	.055
Chrome, green, commercial, bbls.	lb.	.22
Chromic Sulphate, drums	lb.	.26¼
Cobalt Sulphate, drums	lb.	.59
*Copper, Acetate (verdigris), bbls.	lb.	.25
Carbonate, 53/55%, bbls.	lb.	.155
Cyanide, Tech., 100 lb. bbls.	lb.	.34
Sulphate, Tech., crystals, bbls.	lb.	.05
Cream of Tartar (potassium bitartrate), crystals, kegs	lb.	.20¼
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07
Dibutyl Phthalate, l.c.l., drums	lb.	.195
Diethylene Glycol, l.c.l., drums, works	lb.	.17
Dextrine, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Ethyl Acetate, 85%, l.c.l., drums	lb.	.066
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20
Flint, powdered	ton	30.00
Fluorspar No. 1 ground, 97-98%, mines	ton	$40.00
Fusel Oil, refined, drums	lb.	.125-.14
*Gold, Chloride	oz.	$18¼-23
Cyanide, potassium 41%	oz.	$15.45
Cyanide, sodium 46%	oz.	$17.10
Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Sandarac, prime, bags	lb.	.50
Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead, Acetate (Sugar of Lead), bbls.	lb.	.10-.12¾
Oxide (Litharge), bbls.	lb.	.125
Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Mercuric Oxide, red, powder, drums	lb.	$1.61
Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin	lb.	.05-.06
Phosphorus, red	lb.	.40-.44
yellow	lb.	.24-.30
Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Potassium, Bichromate, crystals, casks	lb.	.09¼
Carbonate (potash) 98-100%, drums	lb.	.06¾
Cyanide, 94-96%, cases	lb.	.525
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Quicksilver (Mercury) 76 lb. flasks	flask	$74.-$76.50
Rochelle Salts, crystals, bbls.	lb.	.17¼
Rosin, gum, bbls.	lb.	5.25-7.75
*Silver, Chloride, dry, 100 oz. lots	oz.	.40¼
Cyanide, 100 oz. lots	oz.	.39⅝
Nitrate, 100 oz. lots	oz.	.35
Sodium Carbonate (soda ash), 58%, bbls.	lb.	.0235
Cyanide 96%, 100 lb. drums	lb.	.15
Hydroxide (caustic soda) 76%, flake	lb.	.036
Hyposulphite, crystals, bbls.	lb.	.035-.065
Metasilicate, granular, bbls.	lb.	.0315
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.058
Sesquisilicate, drums	lb.	.0405
*Stannate, drums	lb.	.31-.34
Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Sulphocyanide, drums	lb.	.30-.35
Sulphur, Flowers, bbls., works	lb.	.037-.0419
*Tin Chloride, 100 lb. kegs	lb.	.36½
Toluene (Toluol), pure, drums, works	gal.	.27
Tripoli, powdered	lb.	.03
Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.36-.37
Bees, yellow, crude	lb.	.21-.215
Carnauba, refined, bags	lb.	.35
Montan, bags	lb.	.115-.12
Spermaceti, blocks	lb.	.23-.24
Whiting, Bolted	lb.	.025-.06
Xylene (Xylol), drums, works	gal.	.31
Zinc, carbonate, bbls.	lb.	.14-.15
Cyanide, 100 lb. kegs	lb.	.33
Chloride, granular, drums	lb.	.065
Sulphate, crystals, bbls.	lb.	.04

*Subject to fluctuations in metal prices.

Metal Prices on page 59.